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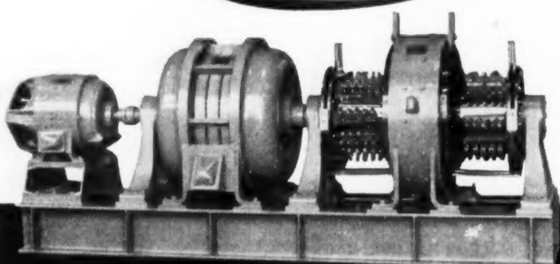

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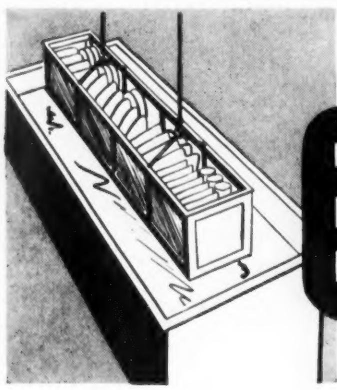

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The New Look in the Finishing Department

Every day we continue to see signs of increased attention and planning being given to the traditional "step-child" of modern manufacturing, the finishing department.

In all too many plants there has existed a "status quo" attitude towards the plating room, with the result that in many plants that can boast of the latest in machine tools, office equipment, and assembly lines, there still can be found a disordered conglomeration of rusty tanks, crocks, wet floors, strange odors, and mysterious people collectively labeled the "plating department".

A very definite trend has been in evidence for some time, and we now begin to see applied to the plating operations the same type of constructive planning and production engineering that has made the other divisions of our manufacturing plants the envy of the world. Efficient layout of plating cycles, critical selection of materials and processes, adequate provisions for drainage and treatment of wastes, increased use of air-conditioning, better ventilation and lighting facilities, adoption of laboratory control for all solutions and coatings, application of specialized materials handling equipment, etc. all are coming into their own as essential to the efficient operation of the department. Along with this we also find increased attention being paid to worker training and safety.

Undoubtedly one of the chief reasons why the modernization of the plating department has lagged behind has been the fact that a large majority of the executives in charge of manufacturing operations have been educated in the art of machine and tool work, and to whom the plating operations have always been more or less of a mystery. Faced with the necessity of reducing production costs to the bone, and unable to do very much in the more efficient machine departments, they have been forced to focus their attention on the finishing department, and the inevitable results of this close scrutiny are now being felt.

Metal Finishing

Wishes You A Very Merry Christmas

Consulting the Floor Doctor

By George Black, *Hollis, N. Y.*

THE plating room has grown to manhood in many ways. Electrical handling equipment, precision and exacting procedures, scientific chemical control are all visual signs of this development. The tremendous impetus of the war years and the terrific postwar demand have combined to give science the definite nod over chance. The large production facilities for applying a wide variety of rust-proofing and electrochemical treatments has resulted in the use of all types of solutions and a host of assorted equipment. The use of these diverse chemicals, plus the additions of new equipment weights have acted together to demonstrate the weaknesses of existing flooring. Engineers have had the opportunity to analyze hundreds upon hundreds of flooring failures; to experiment with a wide range of resistant materials; and to formulate a knowledge of unusual accuracy for the repair and replacement of old floors, as well as for the construction of new ones.

It is not the purpose of this paper to present prescriptions for flooring failures or to advance any one type of flooring as the one to use. Rather, it is hoped to outline the basic characteristics of the various available materials and to present some of the problems which must be considered in the choice of any floor. When the problems are clear and the physical and chemical characteristics of the materials are understood, it will be easier to comprehend the recommendations of the floor engineer.

All photos in this article courtesy of Kayel Engineering Co.

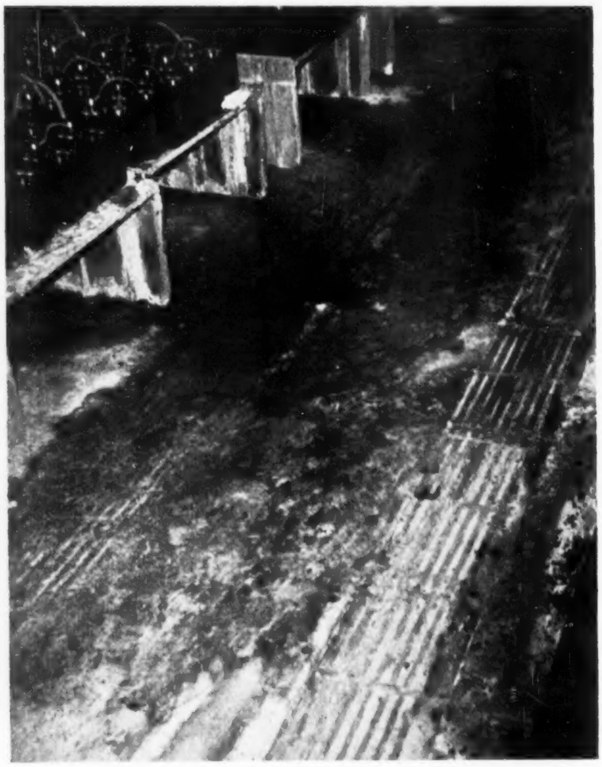

Figure 1. Brick sample in cement floor under acid conditions.

Types of Flooring

The materials available for flooring cover a wide range. Wood, linoleum, rubber, cement, asphalt, magnesite, brick and tile are among those used most often. As far as the plating room is concerned the choice becomes even more limited. A leading flooring engineer lists the following as the five choices open to plating room executives:

1. Wood deck over tar, felt and slag roof.
2. Concrete.
3. Asphalt cold mastic.
4. Asphalt hot mastic.
5. Brick.

The arrangement is in order of expense, the cheapest in view of initial cost at the head of the list. Actually the cost of flooring includes the expense required for maintenance and repair and the cost of work stoppage necessitated by such maintenance, in addition to the original cost. It is entirely reasonable to respect the claims of flooring engineers when, for a given installation, they offer the most expensive flooring as being the cheapest in the long run.

Wood Flooring

Starting at the head of the list, let us look into the properties of wooden flooring. It is known that wood will shrink under dry heat without, however, suffering a loss in strength. Water in excessive quantities will cause a swelling and subsequent distortion as well as a softening of the fiber. Alkaline solutions cause a swelling, whereas acids demonstrate a corrosive effect. Various salts and salt solutions will also effect a swelling action. In spite of the many excellent water repellant treatments for wood, swelling and buckling can hardly be avoided. On the physical side we have the relative softness of wood flooring which makes it of very limited value for heavy traffic, especially when the cutting edges of skids and similar equipment are factors.

Softwood floorings have been used for light service or as support for more durable flooring surfaces. Hardwood, such as northern maple, has considerable

Figure 2. Close-up of brick sample shown in Figure 1.

wear resistance and has even been used successfully in light trucking areas. Wood blocks, four inches thick, set on an asphalt base and jointed with hot asphalt have proved of value in machine shops. But when it comes to plating rooms, the need for chemical resistance is paramount and the use of wood has decided limitations. The wood deck floor over the waterproof base has the advantages of cheap construction. If it is built sectionally so that the deck can be repaired easily without effecting work stoppage it offers a fairly competent temporary floor. However, any repairs which have to be accomplished on the base necessitate complete work stoppage, so that in many cases the wood deck type does not prove economical.

The material in widest use for flooring in industry is concrete; however, for plating rooms it possesses certain inherent weaknesses which limit its value. In any discussion of concrete floors we have to assume that the mixture consists of clean hard aggregates which have been properly apportioned according to rigid instructions; also, that they have been properly and skillfully placed and thoroughly cured so that maximum density and wearing qualities are obtained. Unless we assume these things our discussion has no validity. But the assumption and the fact are different things entirely, unless we are willing to deal only with reliable contractors who specialize in floor construction and are willing to guarantee their work.

The reason we must be so insistant upon such reliability is that slight variations in the concrete mix can produce a material completely unsuited for the purpose for which it is intended. Research chemists have been working for many years on the problems which have presented themselves from actual use of concrete floors. A vast horde of new and worthwhile developments for making concrete more resistant, more durable and more dense for waterproofing, hardening, sealing and curing have been made available. Correct application depends upon thorough understanding and close supervision. Without these, the strides made by research chemists are valueless for industrial usage.

For floor construction, the only type of concrete which is used to any extent is a mixture of portland cement, water and an inert material such as sand or gravel. The chemical composition of a good portland cement is about as follows: lime, 62%, silica, 23%, alumina, 8%, with the remaining 7% consisting of such impurities as iron oxide, magnesia and sulphur products. Being an alkaline material, portland cement is not generally attacked by mild alkalis, but salts in solution constitute a decided danger even to the most dense concrete. In order to prevent leakage through concrete floors, it is recommended that a membrane which usually consists of asphalt impregnated felt, be sandwiched between two layers.

The effect of chemical attack on concrete floors is linked irrevocably with the amount of abrasion and traffic the surface must withstand. The seeming inconsistency which permits concrete tanks to be used for storage of certain liquids which would attack the surface if allowed to remain in contact with a concrete floor is easily understood when it is explained that the reaction of certain chemicals with portland cement produces insoluble salts which block further attack if they are undisturbed. When the surface is disturbed through traffic or water-wash, however, the protective coating is removed and new concrete is exposed to the corroding liquid.

Almost all of the acid solutions used in a plating room will have a destructive effect on concrete floors. Intelligent arrangements of drains so that running liquid removal is handled by acid-proof materials will serve to extend the life of a concrete floor. In recent years research engineers have brought forth many methods for hardening the surface of concrete, thus reducing its porosity and making it more resistant to corrosion. The use of concrete floors is wide-spread; but more and more it is becoming a job for a highly trained technician. Only when the requirements are measured skillfully and provided for by intelligent mixing, surfacing and designing can you be anywhere near certain that your floor will endure and serve the purpose.

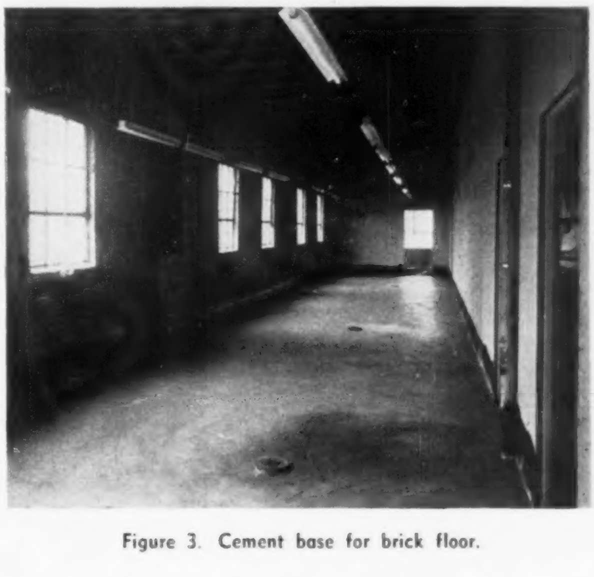

Figure 3. Cement base for brick floor.

Asphalt Mastic

The use of asphalt mastic over a wood or concrete base has found great popularity. When applied cold it has the advantages of low cost and simple installation. In addition, it can be maintained by plant personnel by a simplified patching process. The material is porous and must have a suitable membrane for waterproofing purposes. Cold-applied mastic asphalt floors are used for light and medium service, but their main advantage seems to be as a repair topping for worn wood or concrete floors or as an undercoating for harder surfaced floorings. In these fields it has practically no competition since the cost is low and it may be used to salvage otherwise hopelessly damaged floors.

The hotmastic asphalt floors are composed of asphalt, stone or gravel and sand in very precise proportions, and are placed hot over heavy paper applied to wood or concrete bases. When specified for plating rooms, special acid proof mastic may be obtained. Manufacturers of this hot mastic flooring claim that it is unsurpassed for durability and resiliency as well as for being dustless and non-absorbent.

It is known, however, that the asphalts are subject to cold-flow and will therefore move slowly under pressure. When properly installed, asphalt floors will handle moderate wheeled traffic, but they cannot withstand the cutting edges of skids or barrels. In addition they are affected by hot water washings—the mastic is softened and the aggregate washes out, leaving a spongy mass. Another known weakness is their inability to withstand oils and greases; although this is not a major concern for plating shops, precautions should be taken to catch drippings from machines which may be in service.

Brick Flooring

During the last few years the trend seems to have turned toward brick floors, or rather to a combination flooring system which is brick surfaced. One of the most obvious advantages of ceramic flooring is the simplicity of keeping it clean and the uplift in morale which is generated from a floor which always "looks clean". Unusual wear resistance plus long life are other factors in favor of brick flooring. Figure 2 shows the cross section of a typical floor of this type; it should be obvious why the term combination flooring is used, as brick, cement, asphalt and other materials are all put to use.

Figure 4. Close-up of bricks set in membrane.

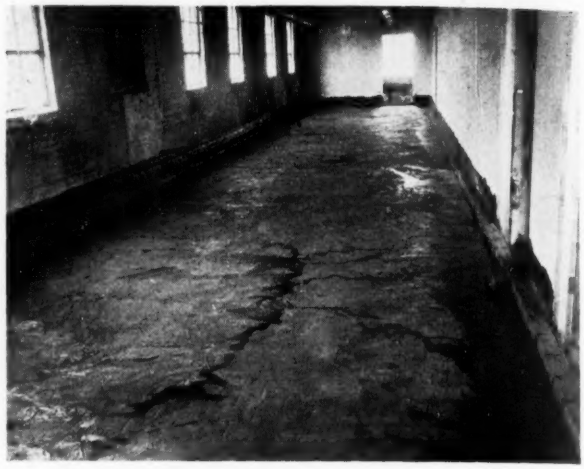

Figure 5. Completed brick floor, showing spread cement.

The following steps are offered as basic for the construction of satisfactory floors of the brick-combination type.

1. Start with a rigid, solid base. The ideal is rigid concrete as thick as necessary to meet traffic conditions. (See Figure 3.)
2. Cover this base with several layers of tarpaper or other waterproof membrane. Take as much care to flash in curbs, drains, etc., as you would for a roof.
3. Further waterproof by applying heavy coating of specially engineered materials.
4. Lay the floor with acid proof brick. (See Figure 4.)
5. Bond the brick by pouring specially prepared cements into the joints. (See Figure 5.)

It should be obvious that no brick floor can be any better than the membrane beneath it and the material used for joints. Although the bricks used may be of the finest quality—hard, dense, tough; although they may have been scientifically manufactured so that all trapped air is removed from the mud before firing, if the joints are poorly made a lot of money will have been wasted. An improper joint will erode and allow traffic wear to break down the edges of adjoining bricks. You can tell a good brick floor by the closeness of the joints, for the finer the joint the less chance there is for corrosive attack on the joining material.

Bricks themselves are not affected by any acids except hydrochloric, nor by alkalis of commonly used strengths. The material used for joints must be scientifically prepared to meet the conditions required. Those joining materials based on portland cement are subject to the same influence which attack the cement used in concrete floors. During the past few years research developments have brought forth synthetic resins which have proved successful as a mortar. Each brick is individually buttered on the

(Concluded on page 76)

Alloys by Electrodeposition

By J. B. Mohler and H. J. Sedusky, *Research Chemists*

HUNDREDS of alloys have been electrodeposited in the laboratory but relatively few have been widely used commercially. Among the reasons contributing to their limited use are the following: Specific alloys are not readily deposited; alloy baths usually require exceptionally close control; a second metal will often cause an inferior plate if more than one metal is co-deposited. Furthermore, the pure metals have done and are doing a good job as an overlay for the basis metal.

Alloys are not produced by merely adding another metal salt to a standard plating bath. If this procedure is followed, the chances of obtaining a specific alloy deposit are small. The second metal salt may give rise to ions that are more electropositive than the metal ions already present. In this case either the original metal, or at best only a trace of the second metal, will deposit even though the concentration in the bath be large. If the second metal salt provides ions that are more electronegative than the metal ions already present then the results obtained are reversed. Now the second metal deposits readily, even though the concentration in the bath is small. If the concentration is moderate, the second metal will deposit exclusively since the original metal is now electropositive.

If a solution contains the salts of two metals and one of the metals is only slightly more electronegative than the other, then alloy deposition may be possible.

From these facts it is possible to formulate a rule for developing new plating baths. *The difference in concentration of the salts of the two metals should not be great.* If this difference must be great, then one metal deposits much more readily than the other. This condition will result in many troubles with an alloy bath since the change in composition of the plate will be sensitive to small changes in the bath.

So far consideration has been only given to the bath, while the final result, the deposit, is the object of the most interest. If the composition of the deposit changes readily with small changes in temperature or current density, then the bath will be too difficult to control for most applications.

There is more to alloy plating than just finding two metals that deposit with the same ease. An appropriate electrolyte may be developed for two such metals but it may be found that the deposit will be rough, treed, pitted or otherwise worthless. There are certain metals that just are not compatible, which is the reason why metal impurities often cause trouble in an ordinary plating bath.

There are other metals that are readily compatible. Lead and tin form solder, copper and zinc form brass; copper and tin form bronze and so on. These alloys that can be cast are also easily plated from the proper baths. From this a second rule may be stated. *Electroplated alloys depend on the natural tendency of the two metals to form an alloy.* Thus if a new alloy is sought, the most success is likely for the same alloys that have been successful metallurgically.

There is certain to be some difference between plated and cast alloys since one is formed cold and the other hot. The equilibrium will be different cold than hot and the crystal size, which has an important effect on the physical properties, will be much smaller for the "cold" alloys.

If numerous alloy baths were being used, it would be in order to discuss typical baths. Since this is not so it is well to consider the general principles of alloy plating.

Alloys will be deposited more and more. What would the metallurgist do if he were largely confined to pure metals?

Most interest is in baths that will deposit two metals simultaneously. However, if a third metal is required, it is often possible to control the concentration of the third metal in the deposit by merely controlling its concentration in the bath. Many variables have to be controlled for two metals but the same variables plus the control of the third metal concentration may control all three. The fact that three metals can be controlled shows that the limitations are endless. In addition it has been shown by the metallurgist that endless properties can be produced in the same base metal by the addition of other metals.

Electrodeposition

The field of electrodeposition includes electroplating, electrorefining, electroforming and electrowinning.[1] Electrowinning consists of electrodeposition of metals from solutions obtained from the treatment of ores. The other three terms define processes in which metal of high purity is usually deposited due to the tendency of each metal to deposit at a definite voltage known as the deposition potential. If a solution contains two metal salts giving rise to two platable metal ions, the ion with the more positive deposition potential will be discharged at the cathode exclusive of the other. The metal that appears on the cathode is known as the nobler metal of the two. It will presently be shown how two metals may be deposited at the same time.

Purity: Purity is associated with certain fixed properties such as specific gravity, melting point and resistivity. In addition, properties such as hardness, tensile strength and elasticity, that may be varied by heat treatment or mechanical working, are of limited range in a single metal.

Also of limited range is the important chemical property: corrosion.

Alloying: By alloying a second metal with a base metal, a new set of properties will result that may be continuously changed by variation of the composition of the alloy. Since single metals of fixed properties are normally produced by electrodeposition, and since these properties are not always exactly what is desired, it follows that alloy deposition offers a means of producing deposits with more desirable properties.

Through the use of a cyanide bath containing copper and zinc, brass is deposited that will bond to steel and on which rubber may be bonded in turn.[2]

By addition of sodium stannate to a copper cyanide bath, a bronze deposit is produced that is more corrosion resistant than copper against certain environments.[3]

Brass, the most widely used electrolytic copper base alloy, has been the subject of many scientific studies to demonstrate that by an electrolytic process, the same phases are quite likely to occur as in the

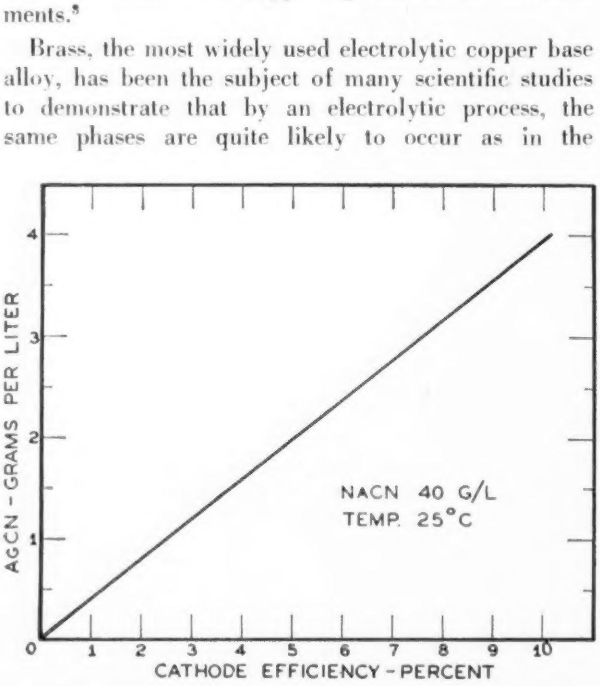

Figure 1. The cathode efficiency of silver strike solutions at a current density of 40 amperes per square foot.

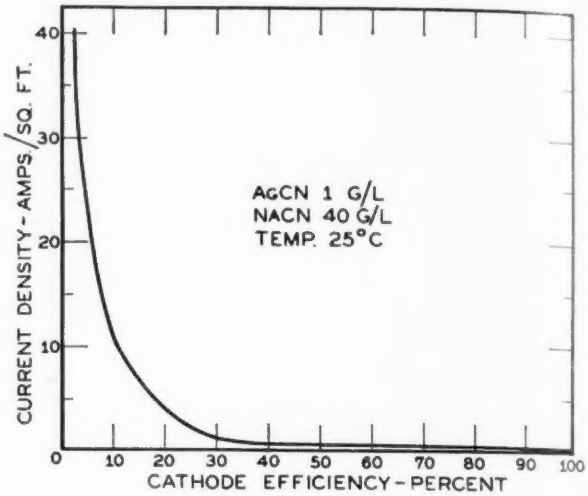

Figure 2. Silver strike solutions. The variation of cathode efficiency with current density.

thermally prepared alloys,[4] and that the deposition of a phase can be detected from the characteristics of the change in potential during electrodeposition induced by changing the current density.

Solder has been deposited commercially from fluoborate solutions[5] for some time, but there is much less known about the process than about brass plating.

There is much interest in two copper base alloys that produce hard, tarnish resistant, white deposits desirable for decorative purposes. Some installations of the first of these, which consists of copper, tin and zinc,[6] were made during the war. Development of the other, which is white bronze of speculum metal composition, was greatly retarded because of the war.[7]

There are other alloy deposits being used, such as nickel-cobalt[8] and karat gold. In addition, the literature indicates increasing interest in many attractive possibilities that may become available for bright deposits, special color effects or reduced costs.[9, 10, 11]

Alloy Baths: The known behavior of alloy baths demonstrates that in practically every case one of the metals tends to deposit more readily than the other. The noble metal in the bath and the amount in the deposit may generally be increased by any of the following means:

1. Decrease in current density.
2. Increase in agitation.
3. Increase in temperature.

All of these conditions tend to decrease cathode polarization, to decrease the thickness of the cathode film, and to cause the deposition potential to more nearly approach the decomposition potential.* These are the conditions that will cause the noble metal to deposit exclusively in competition with the base metal, if they can be carried to an extreme. The noble metal can, of course, be increased by increase in concentration, although it will not always be decreased by increase in concentration of the base metal.

In the ideal alloy bath, the deposition potential of

* The potential at which the metal will just begin to deposit.

both metals would be the same and would change to the same extent for any change in conditions. This is so unlikely that it may be regarded as impossible. However, it may be closely approached as shown by the fact that a brass deposit of uniform color may be obtained on a complicated shape where the current density is not uniform. In the brass bath, the deposition potentials are very close and may even be reversed if desired.

Much may be predicted about an alloy bath, such as bronze, from a knowledge of the cyanide copper bath and the stannate tin bath.

At room temperature, the cathode efficiency of the stannate tin bath is essentially zero so that additions of copper cyanide and sodium cyanide will only result in deposition of copper. At room temperature, the cathode efficiency of the cyanide copper bath is low, and if an excess of sodium cyanide is added to the bath, the deposition of copper will cease.

From these facts and from a knowledge of the effect of caustic on a stannate bath, the following may be predicted:

1. On increase of temperature, the cathode efficiency will increase.
   a. Copper will deposit more rapidly.
   b. Tin will begin to deposit.
2. An increase in free cyanide will decrease the amount of copper in the deposit.
3. An increase in the amount of free caustic will decrease the amount of tin in the deposit.

From a knowledge of the high efficiency copper cyanide bath[12] and from a knowledge of the effect of potassium salts on both the cyanide copper bath[13] and the stannate tin bath,[14] it may be assumed that a high cathode efficiency may be obtained with a lower concentration of metal in the case of potassium salts than in the case of sodium salts.

It is quite likely that the deposition potential of the two metals can be reversed, although the conditions that will result in the minimum difference in

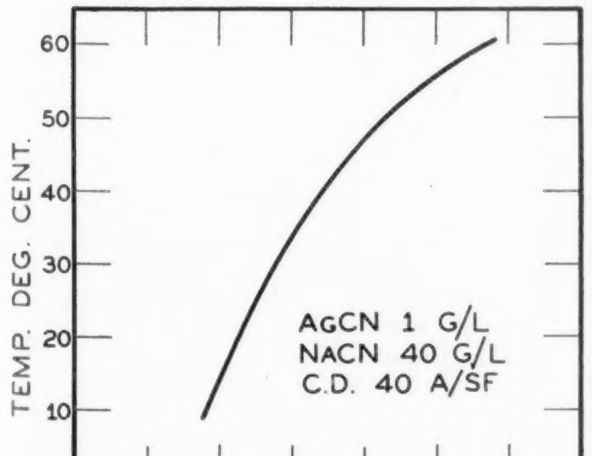

Figure 3. Silver strike solutions. The variation of cathode efficiency with temperature.

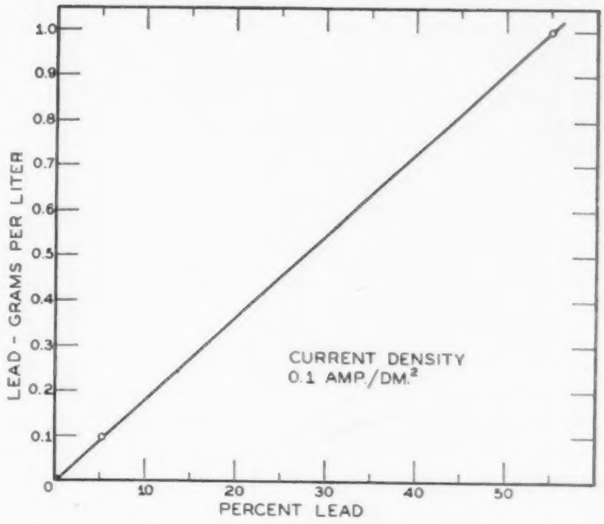

Figure 4. Copper-lead plating bath.

deposition potentials for reasonable control limits and the behavior within these limits can only be found by experiment.

The mechanism of alloy plating may be followed in any bath where two ions are being discharged at the cathode simultaneously, and where the quantity of one of the ions discharged can be measured. This mechanism is readily demonstrated in the behavior of a silver strike where silver and hydrogen are deposited at the cathode at the same time.[15]

Figure 1 shows that the cathode efficiency of a silver strike solution at a constant current density and temperature is directly proportional to the silver cyanide concentration.

This means that silver ions* are being discharged as rapidly as they reach the cathode, and that silver is more noble than hydrogen in a cyanide solution, and further, that if silver is increased in concentration sufficiently, it will deposit exclusively.

The nobility of silver in a strike bath may also be demonstrated by lowering the cathode current density. At a low current density, the cathode efficiency will become essentially one hundred percent as shown in Figure 2.

Figure 3 shows that as the temperature of a silver strike is raised, the cathode efficiency increases approximately 2 percent per degree centigrade. This increase in rate at which the ions reach the cathode corresponds very close with the temperature coefficient for the electrical conductivity of electrolytes.[16] This observation indicates that the cathode film is not so much influenced by a thinning effect due to increase in temperature, but rather that the increase in rate of diffusion of the ions accounts for the increase in cathode efficiency. An increase of 2 percent per degree centigrade corresponds closely with an increase calculated by Dole[17] for the plating rate of gold from a gold-copper cyanide bath.

According to Dole's theory, the gold ion plating

* For a discussion of the nature of the ions discharged at the cathode from cyanide solutions, see M. R. Thompson, The Constitution & Properties of Cyanide Plating Baths. Trans. Electrochem. Soc. 79 417 (1941).

rate is controlled by diffusion and the diffusion rate is influenced most by the change in viscosity with change in temperature.

It is thus seen that silver in a silver cyanide strike bath responds as a noble ion and that for this case, the silver plating rate is controlled by the rate of diffusion across the cathode film.

The quantitative case of the gold-copper alloy analyzed by Dole is interesting in that three ions are discharged; namely, gold, copper and hydrogen. The analysis demonstrated that the copper ion is only partially influenced by diffusion in that the concentration of cyanide is a limiting factor on the copper plating rate. The relative nobility of the ions for the gold-copper-hydrogen case may only be determined for a specific bath since it is obvious that the plating rate of the copper may be stopped by adding sufficient excess cyanide. It is likely that the gold may always act as a noble metal in this system, but that the nobility of the copper may be reversed with respect to hydrogen.

Noble Metal System: An alloy plating system in which the plating rate of a metal depends on the thickness of the cathode film may be called a "noble metal system" or a "diffusion system". Silver in a strike bath or gold in the gold-copper alloy cited are examples of a system of this type.

If the plating rate of the metal is approximately proportional to its concentration in the bath over a wide range, then it must be in a "noble metal system". Data from the work of Meyer and Phillips[18] will illustrate this point. These authors used the following solution to which they added various metal salts and studied the structure of the resulting deposits.

NaCN	35 grams per liter
CuCN	25 " " "
Na_2CO_3	5 " " "
NaOH	15 " " "

It is seen in Figure 4 reconstructed from the data of Meyer and Phillips that lead in the deposit is almost directly proportional to the concentration of lead in the bath and in addition that a low concentration of lead in the bath produces a high percentage of lead in the deposit.

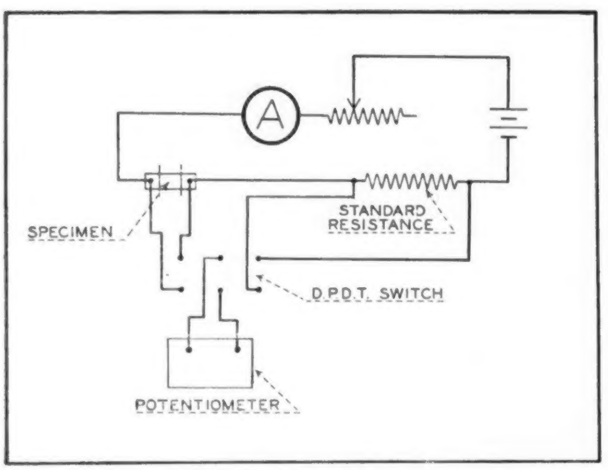

Figure 5. Electric circuit for the measurement of resistivity of electrodeposited alloys.

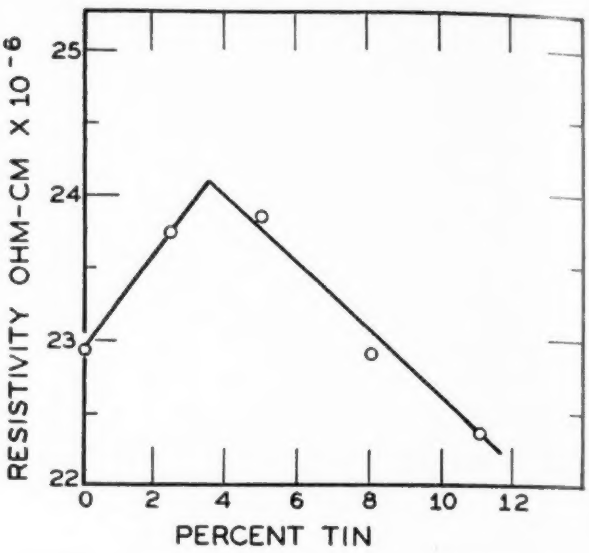

Figure 6. The resistivity of lead-tin alloys at 25 degrees C vs. tin content.

The case for silver is quite similar, but it is possible that the free cyanide or some other variable causes the silver to vary from linearity to a greater extent than the lead.

Potential System: The plating of lead-tin[5] is a system that may be referred to as a "potential system" or a codeposit that depends on the deposition potentials of the two metals concerned being close together. Although the potentials of lead and tin are close together in a fluoborate bath, if both metals are present in substantial amounts, the lead will deposit exclusively at low current density. Increase in current density favors the deposition of tin. Because of these facts, the lead may be designated as the noble metal, but the tin in the deposit may be further increased by the addition of gelatin to the bath.

If an alloy bath is a "potential system", the ratio of metals in the deposit will be readily changed by changing the concentration of either of the metals in the bath.

C. L. Faust[19] pointed out that "the deposition potential of alloy plates has little practical meaning and is not the cause, but the result of at least two electrode reactions that produce the alloy plate". This is an important point and the measurement of potentials or the definition of systems such as "noble metal systems" or "potential systems" should only be used as a convenience to predict how an alloy bath may be expected to react with a changing variable or to estimate what may be done to increase electrode efficiency, to decrease or eliminate immersion plating at the anode, or to obtain chemical concentrations in the bath that are feasible to control.

Future of Alloy Plating

Alloy plating will undoubtedly increase in importance since it is a means of controlling the properties of the deposit.

The use of alloy deposits will spread through the study of many alloys at the same time. Mathers and

Johnson[20] plated silver-base alloys containing copper, nickel, cadmium, zinc, cobalt and lead.

Meyer and Phillips[18] in the course of a theoretical study plated copper-base alloys containing lead, cadmium, zinc, thallium and silver. These studies show that many alloys of a base metal may be prepared. It remains to test the properties of the alloys and to determine how and where the properties will do a more satisfactory job than the properties of a single metal.

Properties of the Deposit

The properties of alloy deposits are important. First, the properties are important because they determine the behavior of the material and suggest the use to which it may be put. Second, the properties are important because they tell us what we have.

What do we have when we have an alloy? In order to answer this we have to answer the question What is an alloy? At this point it is possible to get philosophical and go into a long discussion but instead it is best to take a definition from a good source. In Van Nostrand's Scientific Encyclopedia the following definition is given: "An alloy is a substance having metallic properties, consisting of two or more metallic elements, or of metallic and non-metallic elements, which are miscible with each other when molten, and have not separated into distinct layers when solid." This definition is not too satisfactory for electrodeposited alloys which are formed cold.

First, consider an alloy that contains two elements. Second, define the term phase. For this purpose a phase will be either a pure metal, a solid-solution or an inter-metallic compound. A solid solution is one metal dissolved in another. An inter-metallic compound is a combination of metals in a definite chemical ratio.

More than one phase may be present in an alloy. If a metal is added to a second metal in such a manner that an alloy is produced the first metal may go into solution in the second. When the first metal becomes saturated, a second phase will appear. This second phase may be another solid solution of the second metal in the first. Two phases may be present in an alloy of two metals at the same time; and these phases may be either pure metals, solid solutions or intermetallic compounds.

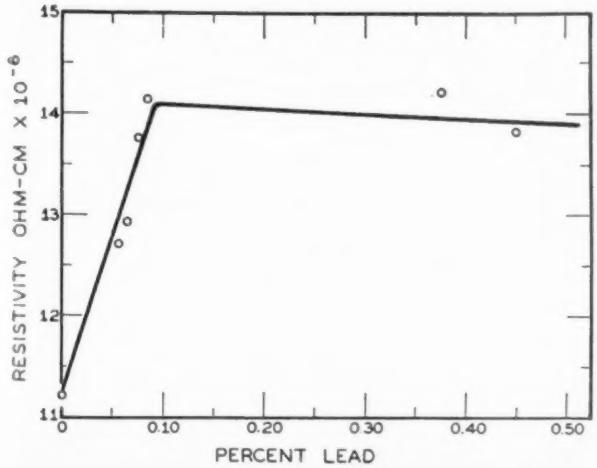

Figure 7. The resistivity of tin-lead alloys at 25 degrees C vs. lead content.

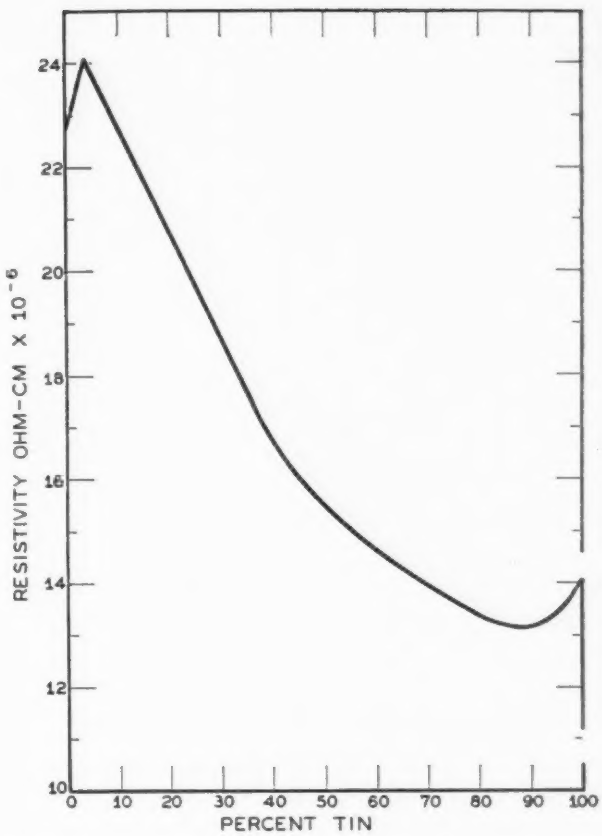

Figure 8. The resistivity of lead-tin alloys of all compositions at 25 degrees C.

When a second phase appears in an alloy a sharp change may take place in the properties of the alloy. The rules governing the phases are not of immediate importance to us but the fact that the properties change with the appearance of a second phase are very important for the following reasons.

1. The properties of the alloy are limited by the appearance of a second phase. For instance, an alloy may have better corrosion resistance than a pure metal but this corrosion resistance might not increase beyond the limit of solid-solubility.

2. The presence of a phase can be detected by the sharp change in properties.

3. With the appearance of a second phase, alloy plating may become impossible. This is not always the case but in some alloys the second phase acts similar to an impurity in ordinary plating baths.

If a series of alloys are prepared, the presence of a second phase may be detected by measurement of the properties of the alloys. The metallurgist often detects the phases by the behavior of the alloys during solidification. The phases may also be detected by a study of the solidified metal. X-ray diffraction or electrical resistivity are two ways of studying the phases in the solid state. These two methods are particularly useful for determining the limit of solid solubility of one metal in another.

The following data is presented on the resistivity

of the plated lead-tin alloys to illustrate two solid-solubility limits.

To obtain these measurements the various alloys were stripped from a cathode and the resistivity was measured. The resistivity was determined by measuring the voltage drop across a definite length of the alloy for a definite amperage. A known resistance was used in series in the circuit as a standard. The diagram for the apparatus is shown in Figure 5.

Figure 6 shows a graph of the data for the resistivity of a series of lead-base alloys containing tin. The break in resistivity indicates a solubility limit of 3.5 percent tin in lead.

Figure 7 shows a graph of the data for the resistivity of a series of tin-base alloys containing lead. The break in resistivity indicates a solubility limit of 0.10 percent lead in tin.

Figure 8 shows a graph for the approximate resistivity of lead-tin alloys of all compositions.

In the case of lead-tin alloys the behavior of the bath during plating does not reveal the presence of a second phase. Nor does the quality of the plate seem to be affected by a second phase. In the case of lead added to a copper bath the second phase is readily apparent from the character of the plate. Very small amounts of lead in the deposit brighten the deposit. Larger amounts cause a rough, treed and worthless plate. The solubility of lead in copper is very low and it can be seen that small amounts are beneficial and large amounts detrimental. The solubility probably does not correspond with the point where the plate changes from bright to rough but the bad effect of an excess of the second phase is very definite.

The limits of solubility are not fixed in alloy deposits. They may shift with change in plating conditions that tend to change the crystal size of the deposit. The solubility limit may also be shifted by heat treating the deposit. The solubility may increase or decrease depending on the natural solubliity limit for a heat treated alloy.

Inter-metallic compounds may also be deposited. An example of such is speculum metal which is the compound CU_3SN. Of course the pure compound can only be obtained for this exact composition, but when the deposit is in the range of this composition, the plate has the properties associated with the compound. The deposit is very hard and brittle. This metal is resistant to wear and has a high reflectivity.

The importance of phases to the alloy deposit can be readily seen. They may impart unusual properties to the plate and on the other hand they may cause trouble in the bath if they are not controlled.

Control of the Alloy Bath

The control of alloy baths is not greatly different than ordinary baths except that closer control is generally required. Two metals have to be controlled rather than one and secondary chemicals such as free cyanide may require narrow limits. Also the anode problem is more complex since either alloy anodes or anodes of two metals will be required. In addition to this it is usually necessary to analyze the deposit as the analysis of the deposit is sensitive to changes in bath conditions.

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Applications of Zinc Coatings by Hot Dipping

By **Robert Steele**, *Los Angeles, Calif.*

The entire field of zinc galvanizing is reviewed in this paper. Two major operations are involved; preparing the surface and coating in a bath of molten zinc by immersion. Variations of the final coating by speltering are described and the equipment required, character of the coating, pickling processes listed. The author has given an interesting summary of this important coating technique.—Ed.

Introduction

THE process of applying zinc coatings by means of a dip into the molten metal is one of the principle methods by means of which zinc is applied to iron and steel surfaces. Other popular processes include electro-plating, sherardizing and metal spraying.

In 1741, Melonin, a French chemist, experimented with the production of zinc coating by the hot dipping method. In 1742, Kemerlin attempted to apply the process for the treatment of kitchen utensils and by 1778, hammered iron sauce pans were coated with zinc by some manufacturers at Rouen in France. In 1836, Sorel was granted a French patent and in 1837, an English patent was granted to W. H. Crawford.

The value of the zinc coating lies in its efficient rust and corrosion resistance. The use of one coat hot dip galvanizing applied to structural metal, fencing and other outdoor utilities has proved its superiority as compared with the application of frequent coats of paint. At the present time, approximately one million tons of metal products are galvanized each year. These include material for such structures as transmission towers, oil well derricks and windmills, as well as plates for ships, awning rods and silo rods.

The hot dip process is very satisfactory for common roofing and for flat sheets. However, for those sheets which require a more uniform and more flexible coating, modifications have been introduced. For maximum adhesion the surface of the steel should be clean and free from rolled-in scale. In order to reduce the iron-zinc layer between the zinc coating and the base metal, aluminum has been added to the spelter bath. An alternative method of effecting this is by reducing the action between the zinc and the steel, by passing the steel through a molten lead bath before immersion in the zinc. Galvanized sheets for flat work are usually roller levelled and then treated to produce a dead flat surface. These operations have not been found to be detrimental to the tightness of the adhesion of the coating. For roofing purposes the sheets are corrugated.

The process of galvanealing is an important modification. The sheets are heat treated as they emerge from the skimming roll, by passing through a furnace maintained at a temperature of 650 degrees C. or higher. After this treatment, the coating consists mainly of an iron-zinc alloy. It has a matte finish, instead of the bright hard surface associated with straight galvanizing. It is very suitable for coating with paints to resist flaking at high temperatures. However, the galvanealed zinc coating is not very flexible; it is found that when it is subjected to a bending operation, minute cracks appear in the coating.

Galvanizing Operation

In the galvanizing of mild steel sheets there are two major operations involved. In the first, there is the preparation of a clean metallic surface which is followed by coating this prepared surface by immersion in a bath of molten zinc. The steel is pickled in sulphuric acid or hydrochloric acid to remove the scale. It is then washed to remove the iron salts as well as the finely divided iron particles; this is combined with scrubbing. The work is then fluxed in

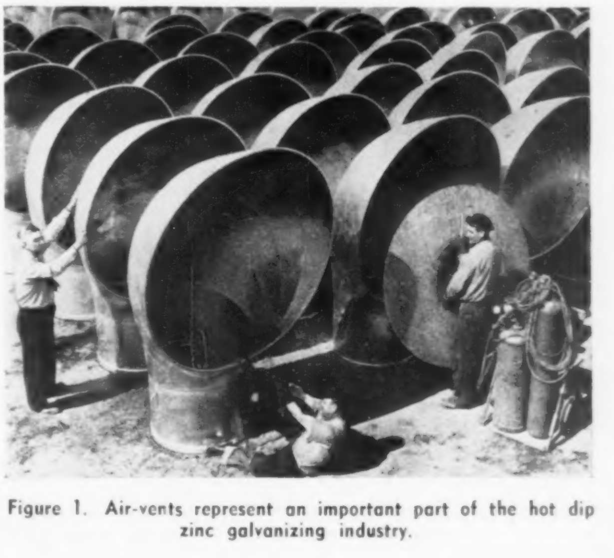

Figure 1. Air-vents represent an important part of the hot dip zinc galvanizing industry.

weak hydrochloric acid or in a strong solution of zinc chloride, or, zinc ammonium chloride. After this, it is then partially dried whereupon it is ready for immersion in the molten zinc.

The pickling solution is generally composed of six percent hot sulphuric acid in which the items are immersed until the scale is completely removed. Agitation here helps to avert any gas pockets and also keeps the acid at a uniform strength. The use of hydrochloric acid is suggested to remove the sulphates of iron from the surface and to replace them with chlorides.

The sheets pass through the flux into the zinc bath. The usual flux is a complex zinc ammonium chloride compound. This dissolves the oxide films from the surface and cleans away the films of reaction products from the pickling process. The flux has the important function of removing impurities such as oxides and iron salts, as well as any water which may have been absorbed on the surface. The zinc ammonium chloride forms iron chloride which is decomposed by the molten zinc to give a clean steel surface which can then alloy with the zinc; the iron reacts with it to yield the dross.

It is important to keep the flux active and clean, so ammonium chloride is continuously added to it. After every 8 hours the flux box is emptied and then cleaned. Various mechanical devices are used to keep the surface of the zinc bath clean at the points of entry and of exit.

Sheets are fed into the bath by driven rolls which are immersed in it; exit from the bath is made between partially submerged spirally grooved rolls. Wire is pulled through guides and then exits through sand,

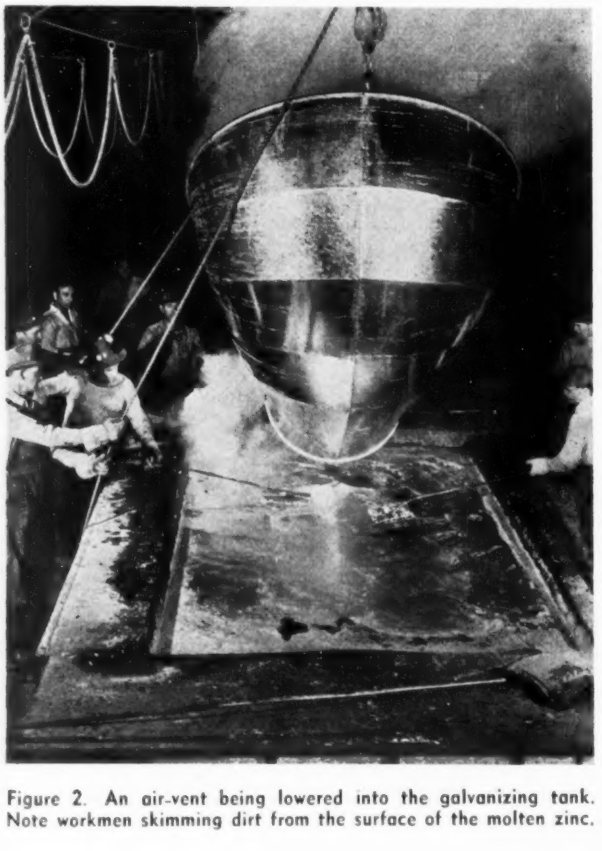

Figure 2. An air-vent being lowered into the galvanizing tank. Note workmen skimming dirt from the surface of the molten zinc.

charcoal or a wad of asbestos mechanically held in contact with it. These exit rolls and wipers smooth the surface as well as remove the excess zinc. Products other than sheet and wire are handled semi-mechanically in order to distribute the coating in an even fashion and to prevent the accumulation of excess zinc in certain sections of their surface.

Small angles are immersed into the kettle or bath of molten zinc and are then worked through the solution with a hook. They are then removed one at a time and drawn through a blower, scraper, or wiper which is arranged so as to remove any excess metal and to distribute the zinc coating evenly around the angle.

Plates, tanks and large irregular shaped articles are immersed into the galvanizing bath one at a time and are then removed separately. Small items such as bolts, nuts and washers are dipped into the zinc, using containers for them. The excess metal is whirled off by using a centrifuge, or by some other mechanical process.

Character of the Zinc Coating

The galvanized sheet leaves the zinc bath with a thin layer of iron zinc alloy in direct contact with the steel base, over which is an external layer of liquid zinc. This latter solidifies and crystallizes to form the familiar coating with the spangled appearance. The spangling phenomenon is dependent upon the number of crystals which are formed. This is proportional to the number of points at which crystallization commences and depends upon the rate of cooling, the method of cooling and upon the composition of the spelter used in the bath.

Careful research has indicated that immediately adjacent to the steel base is a dark colored crystalline alloy of iron and zinc. Next to this is a somewhat thicker layer of hard crystalline alloy which contains a higher proportion of zinc than iron in its composition; its formula is $FeZn_3$. Above this is fairly wide band of hard alloy of iron and zinc which contains much more zinc than the preceding layer and its composition is approximately $FeZn_7$. Above all these layers exists the protective layer which consists of relatively pure zinc.

These various layers of iron alloys which exist between the steel base and the outer layer of substantially pure zinc have an important effect upon the adhesion characteristics of the coating. The character of this alloy depends upon the temperature of the zinc bath, the time of immersion, the composition of the steel and the actual condition of the surface. A thin uniform layer of alloy is most desirable from the standpoint of the adherence of the coating especially when subjected to bending operations.

The presence of cadmium in the zinc tends to cause an embrittlement of the outer layer. Hence, for high quality galvanized wire in which the coating must be heavy and yet not flake when bent in a splice, high purity zinc has to be used. However, for sheet galvanizing it is not essential to use specially prepared pure zinc. Sometimes one to two percent of tin is added to the spelter for sheet and hardware galvaniz-

ing, in order to control the appearance of the spangle.

The appearance of the spangle is also controlled by the use of cooling air, or by the application of ammonium chloride to the still molten coating in order to initiate the process of crystallization and also to modify the spangle pattern. When the coating has been properly applied it is usually resistant to a reasonable amount of abuse, and will also permit shaping operations and sharp bends without the appearance of cracking or peeling of the coating.

The coating varies in thickness from approximately 0.003" to 0.004". This corresponds to 1.8 ounces to 2.5 ounces of coating per square foot. The thickness of coating depends upon the time of immersion in the bath and this also controls the thickness of the alloy section of the film. Again, the speed of withdrawal will control the amount of zinc adhering to the surface. Finally, the resulting thickness is determined by the amount of zinc which is removed by such operations as wiping, jarring or centrifuging.

Pickling Equipment

Sheet pickling by means of machine operations have replaced the older method of hand pickling. The cradles which contain the sheets are composed of such acid resisting materials as phosphor bronze, or monel metal. The pickling machine is designed so as to rock a pair of cradles or, alternatively, to plunge a single cradle up and down. This is arranged so as to agitate both the sheets and the acid and so help the pickling action. The loaded cradles are placed on stirrups which are carried on rocking arms.

The containers usually recommended are wooden tanks built of grooved long leaf pine and lined with sheet lead. The ordinary type of chemical sheet lead tends to creep, crystallize and crack; this necessitates constant repair. For this reason, it is replaced by tellurium lead alloy which contains 0.1 percent of tellurium in it. This lead alloy has a greater resistance to fatigue and resists corrosion induced by sulphuric acid. It also has a finer crystalline structure than ordinary lead. It is tougher and presents no serious difficulties when fabricated. In addition, it can be joined with solder in the same way as ordinary lead.

A lead lined tank protected with acid resisting masonry which is set in sand and sulphur is considered to be superior to wood by some authorities on the matter. Other people recommend rubber lined steel or concrete tanks. The acid resisting rubber is set in a cement junction and is protected with a layer of acid resisting masonry fixed in plastic rubber or acid proof cement.

Pickling Practice

The sheets to be galvanized are loaded into the cradles and these are rocked in the acid until the surface is freed from scale and an etched condition is produced; this will assist the zinc coating to adhere to the base metal. Both sulphuric and hydrochloric acids are used for the pickling process. The study of the pickling operation has been the subject of considerable research. Much investigation has been carried out into the effect of such variables as time, concentration, agitation and their relation to the galvanizing operation.

Figure 3. Quonset huts made by corrugating galvanized sheet.

The solubility of metallic iron in sulphuric acid is greater than that of iron oxide; for this reason the acid attack, is concentrated directly upon the metal beneath the scale. The resulting evolution of hydrogen under the loosened scale causes it to burst off. Un-annealed steel is more vigorously attacked by the acids than annealed steel. An increase in the percentage of carbon, sulphur and phosphorus present in the steel increases the rate of acid attack, while the presence of copper in the usual copper bearing steels make them more resistant than ordinary mild steel.

The solubility is approximately proportional to the concentration of the acid, when this lies within the range of 2 and 20 percent. There is a marked increase in activity at high temperatures and this is caused by an increase in the ion activity as well as by a reduction of the viscosity, which permits these ions to travel at a higher speed. The acid liquid is discarded when the iron content reaches the figure of 18 percent. This is because a sluggish circulation reduces the efficiency of the pickling operation, and then again there is the danger of iron sulphate blocking the grains. Furthermore, agitation accelerates the reaction by removing the hydrogen and by bringing a continuous supply of fresh acid over the surface.

Inhibitors

There are many organic and inorganic compounds which inhibit the action of the acids on the steel base. These include such materials as: size, dextrin, glucose, starch, cellulose, pyridine, quinoline, aldehydes, and arsenious oxide. The inhibitor seems to be absorbed by the metal surface and its efficiency will depend upon some property of the adsorbed film. Some experts have suggested that the inhibitor forms a protective film which possesses a high electrical resistance; this is responsible for a reduction of the rate of migration and diffusion in the metal solution interface.

The actual works practice used by various organi-

zations is largely determined by the available equipment and the local conditions. For general pickling practice, the pickling liquor is first prepared by the dilution of concentrated sulphuric acid with water to yield a solution containing 8 percent acid by weight. The temperature is maintained at 65 degrees C. and the strength maintained at 8 percent continuously by the addition of strong acid at regular intervals. When the specific gravity reaches the figure of 1.2, further additions are discontinued. This results in a gradual lowering of the acid content of the liquor and when this has fallen to a figure of 3.0 percent, the solution is discarded (actually this waste liquor is used for the manufacture of iron sulphate and iron oxide compounds).

The pickling time will depend upon the physical condition of the sheets and upon the strength of the acid. It will vary from 10 minutes for hard sheets to 30 minutes for annealed sheets. The actual pickling time is judged by the success of the galvanizing operation. Any inefficiencies of the pickling operation will manifest themselves quite readily when the galvanized sheets are subjected to the usual laboratory tests.

When the pickling operation has been completed, the cradles are withdrawn. This is followed by a water washing process and they are then conveyed to a water tank in front of the galvanizing machine. Storage in water helps to free the sheets from iron salts and also prevents oxidation. After inspection, the sheets are conveyed into the feeding mechanism of the galvanizing machine.

Galvanizing Equipment

The galvanizing equipment consists of three principle parts; the furnace, the bath and the galvanizing machine. The galvanizing machine consists of a series of rolls, a flux box, and a set of guides between the rolls which are supported in a steel frame. The buildings and plant equipment require careful protection against corrosion. Synthetic resin types of material have been developed for coating the machinery and steel girders.

The action of molten zinc on iron and steel is responsible for heavy repair and replacement of galvanizing machines and baths. Mild steel gives very good service while ordinary steel with a high carbon content shows poor resistance. The 2.21 percent nickel steel is slightly more resistant than mild steel. The silicon steels, on the other hand, are inferior to mild steel.

Galvanizing baths are fired by gas, oil or electricity. The furnace and the flue system are designed to give simple control of the operation and to maintain a uniform temperature of the bath. Oil firing has definite advantages when used with an efficient low pressure burner.

It is advisable to arrange the space where the fuel is burned and also the flues which distributes the hot gases around the bath in a simple straight-forward manner free from complications. This is desirable because any complexity of the design in this part of the mechanism will make very difficult the emptying and the changing of the bath. In addition, simplicity has to be maintained so as to enable the clearing away of the metal which has leaked from the bath into the flues.

To combat the danger of flame impingement directly onto the galvanizing bath, the design can be so arranged as to have it contained in a slightly larger bath. The space between the two baths is filled with lead. This process in which the heat is conducted through the lead, which itself is not reactive with the iron, produces a zinc bath which has a longer life than that heated by direct methods. In addition, the use of a lead bath for heating purposes results in a zinc bath in which a uniform temperature is readily maintained. Electric heating has many advantages including that of a uniform heat distribution, but, unfortunately, the cost of this in many cases is too high for a large scale industrial operation.

The temperature used for sheet galvanizing varies from 430 to 450 degrees C. As the temperature rises to 475 degrees C. there is only a slight increase in the action of the zinc, but at 495 degrees C. there is an abnormal activity. This increased action at high temperatures makes it vital to avoid hot areas on the sides of the bath. The internal attack of the contents upon the bath is supplemented by the action of flames and flue gases on the outside surfaces of the bath.

The galvanizing bath which contains the molten zinc is usually fabricated from steel plates. An average bath measures six feet square, 3¾ feet deep. Welding has replaced riveting for the construction of the bath. The body plate which is welded to the bottom plate is shaped to form the four sides. The plates are manufactured from the best quality mild steel or ingot iron. The life of the bath is influenced by the firing practice, brickwork protection and by the material and general design.

The melting of the spelter requires great care in order to avoid harsh treatment of the bath and to prevent dirty galvanizing work. Great care is needed to prevent overheating. The temperature of the bath is gradually raised to 470 degrees C. to allow the frame to be inserted without running the danger of the metal freezing around the rolls and bearings.

The sheets are removed from the cleaning tanks by the operators who use tongs for this purpose. They are inserted between rubber covered feed rolls which act as squeegee rolls to remove the excessive water from them. These rolls feed the work to a pair of intake iron rolls which lead the sheets into the galvanizing frame through the flux box.

After emerging from the zinc bath the sheets pass through the skimming rolls and are then carried by a chain conveyor into a water cooling bosh. Here, water flows from sprays and is kept, roughly, at about 65 degrees C. In some works the sheets pass through a hot stove to remove the last traces of moisture. In other processes the sheets are cooled in air on large revolving packs.

From this operation they pass through a pair of rubber covered drying rolls. These rolls need the correct vulcanization to give the proper hardness so

as to avoid a soft sticky surface. They are finally flattened by passing them through flattening rolls.

In the last stage of the process the sheets are finished by such operations, as corrugating, curving, patent flattening, roller leveling, re-shearing and ridging. The sheets are then ready for final inspection.

The cleanliness of the galvanizing frame is an important factor to be watched so as to prevent defective work. The iron feed rolls are cleaned with a wet mop in order to remove the flux. The bearings and necks of the skimming rolls are kept free from dirty flux and oxides. Furthermore, it is important to bear in mind that faulty skimming rolls are liable to cause coatings of irregular thickness.

The skimming rolls perform the function of lifting the sheets out of the bath. They remove the excess zinc and by means of their pressure regulate to some extent the thickness of the zinc layer. The best skimming rolls are constructed from well hammered mild steel. The rolls need careful attention in order to maintain a smooth and correct type of iron zinc layer. To give a uniform surface these skimming rolls should revolve smoothly in perfect alignment and possess a well smoothed surface.

The Spelter Bath

The spelter bath is composed of zinc, containing small amounts of such metals as lead, tin, iron, cadmium, copper and aluminum. The composition is adjusted to suit the requirements of the various grades of sheets that are marketed. Adjustments in the composition are also employed so as to remedy application difficulties.

Pure zinc alone will not produce the required spangles; for this reason tin, lead and other metals are added so as to produce the attractive spangled sheets. Tin is used in various proportions; thus for example, in the production of corrugated sheets 0.25 percent is used, while for flat sheets 0.50 percent tin is added. For other special purposes as much as 1.0 percent of tin is added to the bath. As the proportion of tin increases it is found that the uusal bright background disappears and is replaced by white spangles with a flower-like shell finish; it also helps to distribute the zinc in a more uniform fashion. Lead is used in amounts that vary between 0.7 and 1.0 percent. The excess lead settles to the bottom of the bath and there it forms a cushion upon which the dross floats.

As a result of the action of the molten zinc upon the iron machinery, upon the bath and upon the sheets, there is produced a considerable amount of iron zinc alloy which enters into the composition of the contents of the zinc bath and thus forms an intrinsic part of the zinc coating deposited upon the sheets. Some of it also accumulates as a pasty mass which is called the "dross", and this floats on the surface of the lead near the bottom of the bath. The dross is found to consist of $FeZn_7$ in a mixture of 95 percent zinc and 5 percent iron. The yield of dross is approximately 20 pounds per ton of sheet which is galvanized. The galvanizing bath normally shows between 0.02 percent and 0.05 percent of iron. When aluminum is added to the bath the iron content is reduced to almost negligible proportions.

The use of antimony in the spelter bath is found to brighten the surface and so enhances the beauty of the spangles; however, it does tend to increase the danger of peeling. About 0.08 percent of antimony gives large spangles with a fairly tight coating. Cadmium produces bright coatings but is not used because of the pronounced danger of flaking.

It is very important to keep the spelter bath completely free from dirt and oxides by such precautions as "boiling" the bath after "drossing". All the dirty flux is consistently removed. Again, the formation of excessive oxide on the wheels and the bearings of the rolls is prevented as much as possible; attempts are also made to maintain the maximum cleanliness around the machine.

When the temperature of the bath is too high it will produce a whitish type of coating, while if it is too low it will yield an irregular type of rough coating. As a general rule, it is good practice to work the bath at the highest temperature compatible with the production of a well spangled finish. This is because the resulting coating is much smoother and has a more uniform distribution. Again, the lumpiness of the skimming rolls is thereby avoided. Incidentally, spelter additions are constantly added to the bath in order to maintain a uniform level.

The zinc coating is about 0.0017 inches in thickness on each side of the sheets, which works out to about 2 ounces per square foot. Since the resistance to corrosion is mainly dependent upon the formation of a continuous type of zinc layer, it is very important to have freedom from surface blemishes and an even distribution of thickness.

Normally, it is desirable to use good virgin spelter with a specification containing iron at a figure below 0.05 percent; tin is then added to maintain the required percentage. The composition of a particular type of bath which was found to give fairly decent results was the following: tin, 0.48 percent; lead, 0.70 percent; iron, 0.02 percent; copper, 0.05 percent. The usual experience has lead to the conclusion that poor quality remelted spelters with high iron and oxide content should be studiously avoided.

Influence of the Base Metal

Whenever it is found that the steel base does not permit itself to be coated properly it is usually an indication that the surface has not been completely freed from scale and from foreign matter. It is necessary that the surface preparation be efficiently carried out. The methods for achieving this objective were indicated in the early part of this survey. Furthermore, it is necessary to select the correct type of sheets for the purposes of galvanizing. Thus, experience has indicated that mild steel, with reasonable chemical purity, produces high grade galvanized sheets. It is necessary that this mild steel contain a relatively small number of inclusions and should be free from any serious segregation. Furthermore, it

has to be correctly re-heated, then rolled and finally annealed according to sound practice. Galvanized sheets are manufactured from rimmed and killed steels as well as from ingot iron.

Whenever poorly annealed sheets are over-pickled in the surface preparation the result is to produce "grey" sheets. Hard steel is readily attacked by acids with consequent heavy pitting; this etched surface induces the formation of countless numbers of zinc crystals which produce the undesirable "greyness". By retarding the action of the acid with the use of inhibitors as well as by a careful control of the concentration and the temperature of the acid, it is possible to produce well spangled sheets from a hard steel base.

Normalized steel is fairly readily attacked by acid; even when attempts are made to control the potency of the pickling action, the results with this type of base metal are usually poor and irregular. Furthermore, it is found that whenever the surface of a sheet has been subjected to the action of hot gases, a peculiar action occurs which results in the formation of an irregular grey and white finish. Steels which contain a large number of non-metallic inclusions invariably produce small spangles. Finally, it should be noted that the presence of blow holes, cavities and laminations are responsible for producing large and small blisters.

Although the total efficiency of the actual galvanizing operation is obviously very important in producing the correct type of galvanized sheets, yet it must be always remembered that the surface structure of the steel base is also a very important factor. The best surface is that produced by a correctly box annealed sheet. The surface must not be pitted too much as a result of over zealous pickling. On the other hand, the surface must not be rendered too smooth by the cold rolling nor must the pickling action be reduced too much by the use of inhibitors.

When a poorly annealed steel is over pickled, the surface is pitted, dirty and is covered with scum; this produces galvanized sheets which are both dirty and grey. On the other hand, when it is under pickled as is liable fo happen in the case of well annealed sheets, the surface will be whitish in character.

CONSULTING THE FLOOR DOCTOR

(Concluded from page 64)

edges with this resin mortar before being shoved into place, with the result that fine joints are created which are completely resistant to the chemicals used in the plating room. Another interesting find consists of a compound of sulphur and synthetic rubber which is poured while molten into the open joints of a brick floor. This too produces a joint which is nonporous and acidproof, but slightly less resistant to oils than the resin previously mentioned.

The importance of the impervious membrane which is laid between the concrete base and the brick floor should not be underestimated. One of the major flooring companies recommends a layer of asphalt cement having a melting point of 210°F and flexibility as low as 0°F. This material is resistant to all alkalis and most acids. Another manufacturer suggests a compound of specially selected resins, hydrocarbon polymers, elasticators and inert, non-porous filler. This material is non-porous and flexible. It will not crack in the below zero temperature range nor will it sag or run under 170°F. The choice of the membrane should depend upon the purpose of the floor and the resistances required; but it should be obvious, that the choice is one for the specialist to decide.

The two main purposes of the membrane are listed as follows:

1. It permits movement of the brick floor above the concrete base, allowing for the difference in expansions and thereby keeping the floor from cracking.
2. It provides a safety factor, for, should the floor be damaged by a severe blow, the mastic membrane will localize attack and prevent acid liquors from destroying the subbase before repairs can be effected.

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Testing of Alkaline Metal Cleaners

By A. Mankowich, *Darlington, Md.*

The various methods of evaluating alkaline cleaners for procurement, inspection and comparative testing are described, and the limitations and advantages of each are discussed. Correlation between test and practice is one of the most important phases of cleaner evaluation. —Ed.

WITH the trend at present towards laboratory "performance" types of procurement and inspection tests, increasing attention is being given to methods of evaluating alkaline metal cleaners. The objectives of suitable and desirable test methods are fairly obvious. They are (1) precision, (2) convenience, (3) speed, (4) simulation of the degree of cleanliness required in subsequent operations, and (5) correlation between laboratory and plant results. Experience from hundreds of tests of alkaline cleaning solutions has indicated that reproducibility of test results will be good with effective cleaners and will be bad with poor cleaners. Of course, it is necessary to define "effective" and "poor" cleaners, since what is poor cleaning for one purpose may be satisfactory for another. Convenience and speed, or simplicity, of the method are always desirable. Simulation in the test method of the degree of cleanliness required in subsequent operations is of importance from an economic standpoint. It is unwise to set up requirements for a chemically clean surface in the test method when the plant operations require only a physically clean one.

Characteristics of the Methods

Most methods of evaluating alkaline cleaners require the use of (1) highly standardized preparation of test panels for "soil" (oil, grease, etc.) application, (2) "soil" application and aging, (3) cleaning conditions, and (4) rinsing conditions. Test panels, usually of steel, are brought to a definite surface finish with various grades of polishing papers. They are then given a thorough alkaline cleaning, rinsing and drying. The soil application operation may consist of immersing the test panels in an oil at a definite temperature followed by draining of the panel for a definite period at a definite temperature. In the case of a grease soil, a solution of the grease in a solvent such as carbon tetrachloride may be prepared and the panels immersed in this solution. After removal from the soiling solution, the panels are "aged" for a certain time at a certain temperature to remove solvent from the grease film. Standardized soiling procedures result in reproducible amounts of soil on the test panels. The standardized cleaning conditions specify the volume of cleaning solution, capacity of cleaning tank, solution temperature, type of agitation if any and cleaning time. Similarly, rinsing requirements give the volume and number of water dips, capacity of water rinse tank or tanks, time of immersion in water dip, draining time, type of agitation if any and water temperature. It is in the manner of measuring the residual soil on the test panels following cleaning and rinsing that most of the available test methods differ.

Methods of Evaluating Alkaline Cleaners

The methods available for evaluating alkaline metal cleaners include the following: (1) water-break, (2) Nielsen, (3) spray-pattern, (4) fluorescent, (5) weight of residual soil, (6) wiping. In addition a proposed "residue-pattern" method will be described.

Water-break Method: In the water-break method, steel test panels are prepared, soiled, aged, cleaned and water rinsed under standard conditions, then examined for water-break. The test depends upon the fact that a metal surface free of dirt is uniformly wetted by water. Objections have been made to this test on the grounds that water-break is dependent on thickness of water-film, and also that preferential absorption of hydrophilic material causes false water-breakless surface.[1] Two modifications of the method tend to eliminate these objections. The first involves the addition of a 3-5% sulphuric acid dip and water rinse following the original water dip, and is intended to remove adsorbed hydrophilic material. The second modification[2] consists of a dip in a solution of acidified copper sulphate subsequent to the dilute acid dip and water rinse of the first modification. Chemically-clean portions of steel test panels will allow the deposition of a film of copper. The water-break method, as applied originally and in the first modification, is of a qualitative nature, since it re-

veals only whether or not a metal surface has been completely cleaned (with the possible exception of traces of hydrophilic material). The second modification permits of quantitative results because the areas covered by the immersion deposits of copper can be estimated and used as an index of cleaning ability.

Nielsen Method:[2] Quantitative comparisons of cleaning solutions are made by determining the times required to clean soiled test panels. For each alkaline cleaner tested, ten steel test panels are prepared, soiled and cleaned until free of water-break, as indicated by repeated examination of the test panels and checking by the acid dip and immersion copper deposit modifications previously described. Cleaning conditions and soil are chosen to simulate closely plant practice. The time for cleaning each panel is measured, and the average time for the ten panels is used as a "cleaning index".

Spray-pattern Method:[3] In this method, steel test panels, prepared, soiled, cleaned and rinsed under standard conditions, are sprayed with water by an atomizer or a spray gun. Water condenses as droplets on residually-oiled areas, providing a pattern ("spray-pattern") which is sketched on paper ruled into 100 squares. The number of squares covered with a continuous film of water (clean areas, no droplets) is determined for five test panels (10 sides) and the average is called the "cleaning efficiency index". It is interesting to note that in order to eliminate false water-breakless surfaces, this method has recourse to a long rinsing time. The test panel is placed in a tank of running water at 50 degrees C for a total period of 5 minutes, being removed from the tank once each minute during that time; then the panel is rinsed in water at room temperature for 1 minute.

Fluorescent Method:[4,5] This method is based on the fact that mineral oils and animal and vegetable oils containing an added oil-soluble, fluorescent dye, exhibit fluorescence under ultra-violet light. After standard preparation, soiling, cleaning, rinsing and drying, the fluorescence of residual oil on test panels may be observed or photographed under ultra-violet light, the fluorescence being proportional to the amount of residual oil on the panel. The method has been termed unwieldy for procurement and control purposes[5], and is certainly too slow for development work.

Weight of Residual Soil Method: A more practical method, lending itself readily to procurement testing as well as to development work on alkaline cleaners, is one that may be called the weight of residual soil method. As applied in Navy Aeronautical Specification C-109a[6], entitled "Cleaner, Metal, Silicate-Soap", test panels are subjected to standardized preparation, soiling, cleaning and rinsing. Residual soil is then determined by washing the test panels with petroleum ether, evaporating off the solvent from the residue. A modification of the method preferred by the writer is to dry the test panel at 50 degrees C for 20 minutes, after the cleaning and rinsing procedure. On cooling to room temperature, the panel is weighed. It is then washed with benzol, rinsed in ethyl alcohol, dried with paper toweling, and reweighed. The loss in weight is residual soil.

Wiping Method: Reported as having been applied to the evaluation of solvent emulsion cleaners, this method can also be used for evaluating alkaline cleaners, provided the degree of cleanliness indicated by the method is sufficient for subsequent plant operations. The test panel, soiled with mineral oil containing carbon black or a colored pigment, is cleaned and rinsed, and then wiped with white cheese cloth or filter paper. The cloth, or paper, is examined for residual soil.

Residue-pattern Method: The writer has also evaluated alkaline cleaners by what can be called a "residue-pattern" method. The same general procedure is followed as in the weight of residual soil method, the cleaned and rinsed test panel being dried at 50 degrees C for 20 minutes. Where the cleaning has been less than perfect, the test panel will contain areas covered with a characteristic, stained or oily "residue-pattern". The total stained or oily area on a test panel can be estimated and used as an index of detergency.

Discussion

Methods of evaluating alkaline cleaners are required for various purposes. Some of these purposes are:

(1) Laboratory performance test requirement in a specification.
(2) Exploratory work in developing new cleaners.
(3) Laboratory comparison of several competitive cleaners submitted for test for a certain plant cleaning operation.

For development work the method should be rapid and precise. The weight of residual soil method, as modified by the writer, is convenient and rapid, and with effective cleaners gives reproducible results. With ineffective cleaners, duplicate results of the weights of residual soil may vary by more than what might be expected from the normal quantitative method. However, the important factor in exploratory work is to detect the trend of effectiveness of the cleaners tested. This information is readily available from data supplied by the method, since low weights of residual soil indicate effective cleaners. The method will indicate residual soil of the order of 0.1 to 0.2 milligrams for a test panel of approximately 13.0 square inches total area, and will give no change in weight for such a test panel if it has been chemically cleaned.

The "spray-pattern" and fluorescent methods are not as rapid, in the writers opinion. When the weight of residual soil method is combined with observation of presence or absence of water-break and estimation of "residue-pattern", more information is provided than in any other method. The fluorescent method is semi-quantitative at best. The spray-pattern method gives a "cleaning efficiency index", which is a measure of the same area, but all giving the same "cleaning efficiency index". It seems as if the spray-pattern method is most applicable to differentiate

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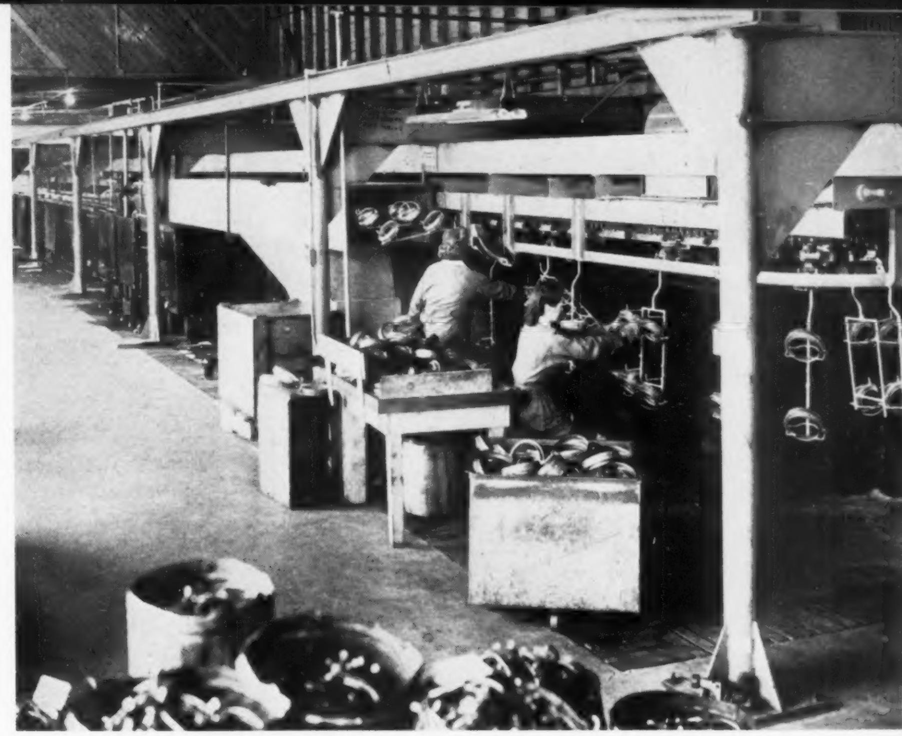


View of women loading and unloading metal parts on zinc plating automatic system.

Introductory Survey of Electroplating—Conclusion

By **Rick Mansell**, *Los Angeles, Calif.*

In this concluding article of this series the author continues a discussion of general plating practice, covering such topics as racks, tanks, and electrical equipment.—Ed.

LARGE objects to be plated are wired or hung on rods which in turn connect with cathode bars. Small objects are usually plated in large quantities in barrels which rotate in the plating solutions. The anodes and cathodes are suspended from metal bars which run lengthwise of the tanks. The cathodes are suspended between two rows of the anodes so that the metal will be deposited evenly on both sides. The cathodes are suspended from the metal rods by means of soft copper wire. Very small objects such as tacks, pins and screws may be placed in a metal basket and suspended from the cathode rod. In an automatic plating arrangement, the objects are hung on rods suspended from conveyors with automatic mechanisms which cause the objects to pass through different baths such as cleaners, dips, plating solutions; they rise out of the tank at one end and dip into the next one by a tripping and raising action connection to the conveyor.

Electrical Equipment

The electrical equipment used is fairly standardized; commercial plating is conducted with motor generator sets or rectifiers, usually with potential of six to twelve volts and with a current depending on the area of the work to be plated at the required current density. In general the voltages used for deposition of the metal are lower than the decomposition voltage of water. However, in the case of chromium and of the alloys such as brass, the deposition potential is above that for the decomposition of water and as a result we get hydrogen evolved at the cathode.

For the still plating of cadmium or zinc a standard six volt power supply is generally used as the source of the current although the actual voltage across the bus bars of the tank is generally kept at two to two and a half volts by means of a rheostat. The size of the power supply required will be determined by the surface area of the metal to be plated. The usual current densities are 10 to 45 amperes per square foot of cathode surface. When dealing with small parts it is going to be very difficult to determine just what the total area of the cathode surface may be. We can estimate the amperage required from the gallonage capacity of the plating tank. Two amperes per gallon will be enough for most work. It is found that current concentrations above three amperes per gallon will tend to heat the solution if the current is passed continuously and will accelerate the decompo-

sition of the cyanide used in the tank. If a tank 34 inches by 16 inches by 13 inches is to be used then the capacity will be a little less than 35 gallons of solution and will require about 70 amperes. If approximately this density is provided it will then be necessary to experiment with various quantities of parts in order to determine just what quantity can be given a satisfactory plate in a reasonable length of time.

For barrel plating there is a great variation in current requirement. It is difficult to measure the actual current density owing to the uncertainty of the effective cathode area, for at any given time only part of the objects are actually in the circuit, and of them only a small proportion of the surface is effective. Usually a very much higher voltage is used in barrel plating than would be needed for still plating—the voltage used may range from 6 to 14 volts. In barrel plating it is best to follow the actual recommendations of the manufacturers of the barrel; or alternatively to find out by experiments what the best plating range is for a given volume of parts. As a typical example, in a certain plating barrel it was found that for 100 pounds of bolts in 100 gallons of solution the optimum conditions were 300 amperes at six volts.

The power supply is set conveniently at a place near where the current is to be used, in order to avoid unnecessary loss of power. The bus bars will be made of copper. Flat ones are preferred to round ones since they can be more easily run around projections and the various lengths bolted together. In addition the flat shape gives additional surface for radiation. A convenient size for a small plant is one inch by a quarter of an inch which will carry up to 200 amperes. Wherever possible, the connections between bars should be made permanent by soldering them together.

Containers

Iron or steel tanks are used almost exclusively for zinc or cadmium plating. The cleaning tank also should be steel and the rinse following cleaning or plating should be of steel as well. The tanks should be of heavy metal with welded seams, preferably with a double lap weld. The metal should not be burnt, that is to say that there should be no oxide inclusion in the weld. Iron oxide is appreciably soluble in cyanide and this may cause leaks to develop. The tanks should be properly insulated from the water and heating lines and the legs should be placed on glazed brick or some similar material which will not become wet. Care should be exercised in the plating tank that the bus bars are well insulated from the tank so that the tank itself is not in the electrical circuit.

Wood tanks are used for the acid pickle and for the rinse following the pickle. It is found that yellow pine is one of the most suitable tank materials. The joints should be tongued and grooved. The tanks should be reinforced not only with brass bolts at the ends but also with rods running through the boards at intervals of 18 to 24 inches. Thus for example there would be in a tank 3 feet by 6 feet by 3 feet one rod in each end, three in each side, and three in the bottom. Asphalt or tar should be used for lining, applied

Conveyorized plating setup. Note semi-automatic plating machine in background. Parts in foreground are being rinsed and dried continuously.

either simply by melting and brushing on, or by melting and thinning with benzol. The tar should have a melting point not lower than 390 degrees F. and should not soften or flow at temperatures up to 135 degrees F.; it should be hard but not brittle at ordinary temperatures.

Apart from welded steel tanks and asphalted wood tanks, wood lined with lead is often encountered. Rubber lined steel is used for acid pickles, acid copper baths and for nickel baths. Lead lined steel and wood are used for sulphuric acid pickles, acid copper baths and for chromium plating. Acid proof stoneware is used for dips containing nitric acid and for small plating baths.

Having considered the general field of electroplating we can now devote a little time to a consideration of the selection of individual plated coatings and we shall follow that by brief surveys of the plating of cadmium, zinc, nickel, chromium and copper, which will conclude the general survey of the science and art of electroplating. The word art is included in the text because while electroplating is definitely a science in its basic theory, it is an art in the practical application of the knowledge to suit individual cases, bearing in mind that the industrial conditions of electroplating are entirely different from laboratory work. Sacrifices have always to be made to meet the production schedules and conditions.

Individual Plated Coatings

Cadmium and zinc coatings are used extensively on parts where appearance is not important but where extremely high resistance to rust is desired. These two metals are anodic to the base metal and are themselves sacrificed. The thickness used is about 0.0005 of an inch or less. In the cases of nickel, copper, chromium, tin, silver and gold the coatings have to be pore free and usually require a thicker coating for maximum protection, anywhere from 0.0005 to 0.0010 of an inch being required. Food handling equipment is usually finished with tin. Chromium coatings are used for gages, cutting tools, engine cylinders, and pistons. Copper and nickel are used to build up dimensions on worn or improperly machined parts. The platings of silver and tin aids in performance of soldering operations. Copper and silver platings are

used to prepare steel surfaces for brazing. Chromium alloys are difficult to coat with most metals except chromium. Again it is found that bright nickel and zinc platings do not always work to advantage on cast iron parts. The range of cost of coating a square foot in area and one thousandth of an inch thickness varies from six cents for zinc to 50 dollars for gold; to these we have to add labor and operating costs. To get an idea of the relative costs involved let us consider the case of an electric iron coated with nickel and chromium; the cost of grinding and polishing operations will be about 20 cents; the plating materials will cost 3 cents; the plating labor 7 cents; and the cost of buffing and coloring will be about 17 cents.

Cadmium platings are used extensively in the metal manufacturing and the auto industries. If cadmium is plated from slightly acid chloride or sulphate solutions then the deposits are coarsely crystalline and are not satisfactory unless addition agents are present. In commercial plating the cyanide bath is preferred. The baths are prepared by the solution of cadmium cyanide or cadmium oxide in sodium cyanide to which addition agents such as glue, casein, molasses or goulac are added to brighten it; nickel salts in small amounts may be added as brighteners. The anodes are of pure metallic cadmium although quite often a combination of both cadmium and steel are employed and the areas are adjusted to meet the operating conditions. Here is a typical bath: Cadmium oxide at 6 ounces per gallon, sodium cyanide at 16 ounces per gallon, organic and inorganic addition agents as brighteners, temperature 70 to 95 degrees F. and the amperes per square foot varying from 10 to 30.

Zinc plating baths principally are the acid sulphate and the alkaline cyanide solutions. The cyanide solutions show better throwing power and are most useful for parts with deep recesses. The acid solutions give smooth white deposits but have poor throwing power. A typical acid bath is composed of zinc sulphate at 50 ounces per gallon, aluminum chloride at 3 ounces per gallon, sodium sulphate at 10 ounces per gallon. The pH is between 3 and 4, and the temperature between 70 and 95 degrees F. The amperes per square foot range is between 20 and 50. The cyanide bath may be composed of zinc cyanide at 8 ounces per gallon and sodium cyanide at 3 ounces per gallon together with 7 ounces per gallon of caustic soda. The temperature is between 70 and 95 degrees F. and the amperes per square foot between 10 and 30.

Nickel is used extensively because of its good wearing qualities and its pleasing appearance when polished; also because of the fact that it is not blackened by sulphur compounds and its only very slight tendency to oxidize in the presence of moisture. It also makes excellent undercoats for plating with other metals. The operation of nickel plating solutions is complicated by the fact that when used as an anode the pure nickel shows a tendency to passivity and so the anodes used contain additions of cobalt, iron, copper and sulphur; chlorides are also added to the plating bath to assist anode corrosion. For plating on steel or brass at low current densities the following plating solution is used. Nickel sulphate at 16 ounces per gallon, ammonium chloride at 2 ounces per gallon, boric acid at 2 ounces per gallon, the pH is kept at 5.3, the temperature at between 70 and 90 degrees F. and the amperage per square foot between 10 and 20. When it is desired to plate on steel or brass at high current densities the following solution is used: nickel sulphate at 30 to 40 ounces per gallon, nickel chloride at 6 ounces per gallon, boric acid at 4 ounces per gallon, the temperature is kept between 100 and 150 degrees F. and the amperage between 20 and 50 amps. per sq. ft.

Chromium is widely used when a lasting bright and highly corrosion resistant finish is desired. It is most often plated over a nickel undercoat. The metal is deposited at low current efficiencies, lead anodes being employed in a bath consisting of chromic acid plus small amounts of sulphuric acid. The platings are very smooth and may be produced in mirror-like finishes; they resist oxidation and tarnish. Best resistance to corrosion is obtained by plating with successive layers of copper, nickel and chromium. The extreme hardness of chromium makes it very useful for places where resistance to wear is essential. A typical bath would consist of 30 to 50 ounces of chromic acid per gallon together with 0.3 to 0.5 ounces of sulphuric acid per gallon; the ratio of CrO_3 to H_2SO_4 being kept at 100 to 1. The temperature is kept between 100 and 160 degrees F. and the current density between 60 and 500 amperes per square foot.

Copper coatings have been largely superceded by other types; it being used mainly as an undercoat for nickel. The two principal baths in commercial use are the acid sulphate and the alkaline cyanide solutions. The copper deposits form a base for ornamental finishes and for subsequent plating with other metals. The acid copper bath used for electrotyping or for depositing copper on brass contains 27 ounces per gallon of copper sulphate and 8 ounces per gallon of sulphuric acid, the temperature is between 75 and 120 degrees F. and the amperage per square foot between 20 and 40. The cyanide copper bath is essentially a solution of sodium cuprocyanide, and is prepared from basic cupric carbonate, sodium cyanide and sodium carbonate. A typical cyanide bath for plating copper directly on steel as well as on brass or zinc contains 3 ounces per gallon of cuprous cyanide, 4½ ounces per gallon of sodium cyanide, 2 ounces per gallon of sodium carbonate with 1 ounce per gallon of free sodium cyanide existing apart from the cuprocyanide of sodium. The temperature is between 95 and 120 degrees F. and the amperage between 3 and 15 amperes per square foot.

Conclusion

The composition of all the baths given previously was not meant to be indicative of actual plating procedures but merely to illustrate some of the principles referred to in the main body of the survey. Accurate compositions and more complete details of the procedures are found in the literature on the subject which really is very comprehensive. The main impetus in the production of this paper has been merely to provide an "introduction" into the fascinating science and art of electroplating.

(*Courtesy Gerity-Michigan Die Casting Co.*)
General view of a modern mechanical finishing plant.

Modern Mechanical Surface Finishing—Conclusion

By Martin Manler, *Cleveland, Ohio*

In this concluding article, the author discusses the various factors affecting the efficiency of polishing wheels, buffs, belts, and buffing compounds, with emphasis on the variations required for different metals.—Ed.

POLISHING wheels should be coated in a draft-free room maintained at a temperature of approximately 80° F. to prevent the glue from jelling rapidly. Hot glue solution is brushed on the face of the wheel, which is immediately rolled in a trough of abrasive grain until it has picked up all the grain it can possibly hold. Glue application and the entire setting-up operation should be performed as quickly as possible to minimize jelling. For a glue jelled during set-up, experience has long proved, is a poor adhesive for abrasive grain.

Since the downward pressure employed to roll the glued wheel is a critical factor in determining the polishing action secured, uniform pressure must be applied while rolling wheel in grain trough. This is very important. For example, it has been found that when a 200-pound man and 130-pound man set up wheels and each uses his maximum strength, the wheels will give different polishing performance.[3]

Also, it is important to heat the abrasive before applying.[6] Tests indicate that the grain and cloth wheels should be preheated to a temperature between 100° and 120° F., to prevent glue from jelling too rapidly during set-up of wheels[3] so that it will displace the moisture when it is bonded. This is particularly true of a good grade of alveolated abrasive.[8] With abrasive grain and wheel properly preheated, glue solution usually can be applied at a temperature of 140° F.[3]

However, if abrasive and wheels are cold or only at normal room temperature, rapid jelling of glue can be retarded by heating it up to 160° F. before using. This, says one eminent authority, is only a stop-gap at best and, therefore, is not recommended as standard practice. With cold wheels and grain jelling, the glue rapidly reduces its adhesive qualities and as previously indicated, abrasive grain will not penetrate as readily into the jelled glue film.

Since the grain thus fails to pack as well on the glue head, the amount of glue in relation to that of grain is excessive, resulting in a wheel head that cuts too slowly and generates excess heat. Other dry room conditions which have proved satisfactory are a temperature of 75° F. and 45% relative humidity, and 90° F. and 55% relative humidity.[3]

Under controlled conditions, the actual time needed to dry a polishing wheel depends chiefly on the density and thickness of the abrasive-glue head and, to less extent, on the density of the cloth or leather, etc., of the wheel itself. An over-dried wheel becomes brittle and its life shortened since the abrasive grains tear out of the sockets before they have done their maximum work; an under-dried wheel cuts slowly, glazes rapidly, overheats, and pieces sometimes scale off because the glue does not develop its greatest possible strength.[3]

Wheel Drying

In drying polishing wheels, it is important to control temperature and relative humidity since animal hide glue has the property of taking on or giving off moisture, depending on prevailing weather or on the relative humidity in the dry room. Hide glue reaches its maximum strength when it contains 10% to 12% moisture, so wheels should be dried until the glue possesses this moisture content, which means that the dry room should be regulated for both temperature and relative humidity.

Ideal drying conditions are said to be 85° and 50% relative humidity, and if they can be maintained with reasonable accuracy, most one-coat polishing wheels can be dried within 24 hours and two-coat wheels within 48 hours.[3]

Drying time depends on thickness of wheel head. The general rule is that the thicker the head, the longer the drying time. Head thickness, in turn, is determined by glue strength, abrasive grain size, and number of coats. A wheel set up with coarse grain, for example, requires a heavier glue solution than one set up with fine grain. For the same number of coats the head is thicker with the coarser grain, requiring a longer drying time. A practical test to find out when a wheel head is sufficiently dry is to hit it with a round steel bar and note the readiness with which it cracks.[3]

Factors of Efficient Polishing

Many factors affect each polishing operation with varying degrees of importance. Among them are the metal itself, surface condition and amount of stock to be removed, wheel operating speed, wheel preparation and condition, properly cracking the wheel head, and wheel rotation direction.

First of all, the physical characteristics of the metal must be taken into account. Carbon steel, stainless steel, cast or sheet aluminum, zinc die castings, Monel, nickel, cast brass—each offers different polishing problems as later explained.

Size of grain to be used for roughing can be properly specified only when surface condition of the metal is fully known. If a ferrous part is scaled, for example, pickling, tumbling, or shot-blasting may be required. In the case of stainless sheet the surface may or may not contain many pits which, if present, would require spot polishing and greater stock removal.[3]

Regulation of surface feet per minute is a decisive factor in polishing efficiency and economy; in fact it is the most important principle above all others in good polishing since glue, cements, and greaseless compounds are made for a certain speed range.[5] Operating speed requires careful study so as to determine how to set up the most economical wheel.

Average polishing wheel speed is approximately 7,500 surface feet per minute. If speed is considerably higher, 9,000 s.f.p.m. say, it is necessary to set up a denser wheel head by increasing glue mix strength by approximately 5%.[3]

Due to differences in hardness of metals, surface feet per minute varies from metal to metal.[8] For polishing stainless steel or Monel, a set-up wheel should be run at 9,000 s.f.p.m.; for brass, 6,800;[8] for aluminum, from 6,000[5] to 7,500;[9] for zinc alloy die castings, from 5,000 to 10,000, with about 8,000 being the lineal speed most frequently used.[10]

Regarding wheel preparation and condition, several points must be considered. First, wheels should always be put in balance before use to avoid bumping and dressing, and kept in perfect balance at all times. This assures longer wheel life, a better finish, less wear and tear on the polishing machine itself, and conserves time, glue and abrasive as well.[3,6]

Secondly, the wheel should be true. Grain and glue are removed with an abrasive brick or the end of a one-inch pipe. Wheel face is then put in truth with a sharp tool. A suitable tool for this work may be made from an old file.[3]

Next comes sizing. A method generally used is to size the wheel and hang it up to dry, after which it is placed on the lathe at running speed and the face lightly rubbed with a fine abrasive brick so as to raise the nap slightly which, in turn, gives abrasive and glue better adherence.

Fourth, cracking or breaking the wheel head. For this operation, a round bar or pipe is used to hit the wheel diagonally across the face. This is done around the entire wheel one or two times, with the wheel face being struck at about a 45° angle. The wheel is then held so that the bar falls across the face at an angle and forms a cross with the first series of cracks. Careless use of sharp tools in numerous plants and shops often results in chips being torn from the wheel face, thus

Aluminum sand casting being given a preliminary grind to remove scratches and uneven spots. A smooth wheel faced with 60 to 100 mesh emery can be used to perform this operation also.

shortening life and reducing efficiency of wheels.[3]

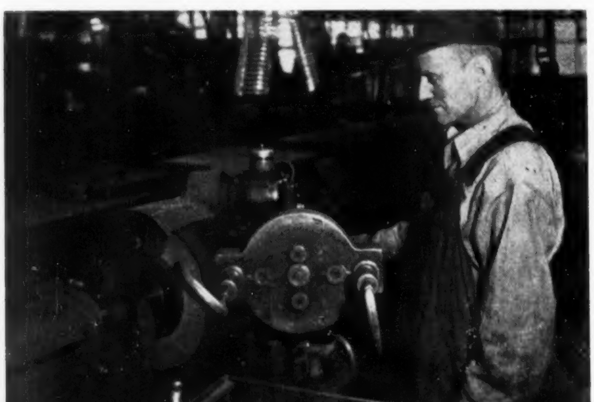
Fifth, direction of wheel rotation. In truing a new canvas, muslin or felt wheel, a nap is laid back on the face of the cloth. To keep this nap lying in the same direction of wheel rotation, the wheel should be mounted on the spindle to keep direction of wheel rotation always the same. Rotating a wheel in the wrong direction may be likened to stroking a fur the wrong way; life of such a wheel is generally short, as the abrasive breaks out readily. It is good practice to guard against this possibility by painting an arrow on the side of all wheels to indicate how they should rotate.[3]

Polishing Different Metals

Summarized in digest style below to conserve space and to expedite reference are general recommendations for polishing different metals. While these are based on average successful practice, it should be remembered that each metal often presents a particular polishing problem, different from that encountered in other metals. Due to such variables, these recommendations may have to be adapted in some instances to meet individual requirements. It should be pointed out, also, that abrasive manufacturers, polishing equipment producers, and polishing accessories suppliers have competent, trained field service personnel who are always glad to help any plant confronted with a particularly difficult or unusual polishing problem to find the right answer.

ALUMINUM

Roughing: Employed as preliminary step in polishing very uneven or deeply scratched surfaces. Die castings and deep-drawn articles fabricated from sheet do not necessarily require roughing unless their surfaces are unusually rough or marked; sand castings always receive this treatment. Various type wheels used, to which is applied layer of glue embedded with No. 60-100 emery or fused aluminum oxide abrasive. Wheel should have peripheral speed of about 6,000 feet per minute. Lubricant such as tallow or tallow-lard oil mixture may be used on wheel to reduce heating, but must be handled carefully to avoid drawing lubricant into pores of castings and spotting the surface by seepage in some later finishing operation.[8, 9]



(Courtesy Norton Co., Worcester, Mass.)

Polishing die cast automobile door handles in one motor car manufacturing plant. One greasing operation precedes buffing.

Greasing: Also called oiling, this finishing treatment is a refinement of roughing procedure and similar to it except that lubricant, such as tallow, oil, beeswax or tallow compositions, is always employed on sheepskin or felt wheel faced with No. 100 to No. 200 emery to reduce danger of burning. Sand castings invariably receive this treatment after roughing; die castings get it as first polishing operation; fabricated articles roughed on rag or canvas wheel require it as preliminary operation before buffing. Wheel greasing operation is generally sufficient, but higher polish may be secured by using wheel faced with No. 100 emery followed by treatment with second wheel faced with No. 220 emery.[3, 5, 8]

BRASS

Sand Cast Brass: Successfully roughed with No. 60, No. 70 or No. 80 grain, followed by second operation on Spanish felt or sewed sheepskin wheel set up with No. 150 or No. 180. Compress wheel employed for parts where hard wheel is desirable; sheepskin wheel used on round, irregular pieces requiring more flexible wheel. Roughing and finishing wheels are oiled or greased; grease stick of tallow commonly used lubricating agent.[3]

Sheet Brass: Aluminum oxide abrasive in sizes 180 to 220 and finer are used, with die marks or scratches in sheet governing factors. Type of wheel depends on shape of article to be polished. One polishing operation usually sufficient to prepare sheet for final buffing. Lubricant should be used on wheel, similar to cast brass.[3]

Brass-Satin Finish: Brushed brass or satin finish produced with greaseless compounds. Brush finish of type used on cheaper grades of hardware produced by roughing casting with soft sewed buff wheel set up with No. 80 grit, then buffing with greaseless compound containing No. 120 or No. 150 aluminum oxide abrasive or with wire brush. Better satin finish obtained by adding second operation in polishing process. Roughing wheel scratches removed with wheel set up with No. 150 or No. 180, then article buffed with greaseless compound containing finer abrasive.[3]

STAINLESS STEEL

Preparatory treatment for polishing very important; material must be freed from scale. Nitric acid bath required to produce maximum degree of corrosion resistance. Abrasive having grit of 150 to 180 ordinarily recommended for 18-8 sheets, followed by 200 emery, 240 flour and alumina buffing compound.[11]

ZINC

Articles formed from rolled zinc or die cast from zinc alloys generally require surface preparation before finishing. Die castings normally require polishing operation only to remove parting fins and gate stubs, accomplished by using specially constructed

trimming dies and then polishing with set-up wheels. Various type wheels used. Both artificial and natural emery of widely varied size employed, with 180-mesh apparently preferred for final stage of polishing where only parting lines are being polished. Last stage of polishing usually performed with greasy lubricant, frequently tallow, on the wheel. Lineal speeds vary from 5,000 to 10,000 feet per minute, about 8,000 feet per minute being most commonly utilized.[10]

MONEL METAL AND PURE NICKEL

Any effect from a sandblast finish to highly lustrous mirror finish is obtainable, depending on character of metal and polishing equipment. Number of operations required depends on coarseness of first wheel applied. Spirally machine-sewed wheels of tightly woven unbleached cotton recommended for roughing and dry fining, and a more resilient and flexible wheel for greasing. Wheel speed ranges from 6,000 to 7,500. Grit numbers range; 60-80, roughing; 100-120, dry fining; 150-180, greasing.[6]

STEEL SHEET STOCK

Preparing sheet steel stock for finishing seldom requires more than two operations, with one frequently being sufficient. Die marks and condition of welded seams govern preparation work necessary. No. 120 grain usually O. K., but when imperfections in metal exist requiring large stock removal, they should be taken care of before hand. Welded seams ground down with grinding wheel; high and low spots filed and hammered out and die marks and grinding wheel marks removed with No. 90 grain polishing wheel. More economical on stock containing pits, scale or heavy die marks to perform job in two operations, using No. 80 or No. 90 for roughing and following with No. 120 or No. 150 grain.[3] In rubbing down organic finishes, aluminum oxide cloth in a medium grit No. 60—No. 100 proved most suitable. Water most common lubricant used for this work.[12]

Belt Finishing

Many polishing operations are performed on endless canvas or leather belts set up with abrasive and glue. When necessary the belts are recoated usually by one of the following methods:[3]

1. A suitable paste is made by adding preheated abrasive grain to the glue solution. For most polishing jobs the paste should contain the maximum amount of abrasive which will leave a workable consistency when spread on the belts with a trowel, knife or brush.

2. Another method is to paint the belt with glue and sprinkle the abrasive on this surface. This method is satisfactory for many operations where the finer sizes of abrasive grain are employed. On severe polishing jobs with coarse abrasive grain it is necessary to press the grain more firmly into the glue by using a roller or similar device. Belts set up in sizes 60 and coarser are often given a size coat, using solution of 8 parts water and 1 part glue. Coated belts should be dried under the same conditions outlined for polishing wheels.

(Courtesy Norton Co., Worcester, Mass.)

Rough-polishing cast iron floor lamp parts with No. 60 emery in one Michigan job plating establishment.

The recent war effort saw a remarkable rise in the use of engineered-finishing with factory-prepared abrasive-coated belts due to the speed, ease and economy made possible by new idler backstand machines as well as effective adaptations of existing models. With this fast-moving trend already having been widely reported and discussed in contemporary technical literature, there is no further need to go into it here.

Yet it should be said, however, that small castings, forgings, stampings and hardware requiring partial or overall finish are proving especially satisfactory for backstand belt polishing application whether for final finish or subsequent electroplating operations, and its rapidly diversified applications are expected to widen in range still further in the period that lies ahead.[13, 14]

Buffing and Burring

Buffing, a term usually considered as embracing the two operations of "cutting down" and "coloring," is distinct from polishing or grinding in that the abrasive is applied to the wheel in the form of a bar, stick or liquid with a binder instead of the abrasive being glued to the wheel.[7]

This method is employed (a) where the surface does not require removal of an excessive amount of metal, or (b) as a final finishing operation after preliminary polishing to obtain high luster. Buffing, then, is generally the preliminary step performed with a sharp or fast-cutting buffing compound to smooth the surface and bring up as bright a finish as possible in one operation. Should a higher or brighter finish be required, the second operation, coloring, is performed, using a milder buffing compound.[4, 7]

It should be emphasized at the outset that buffing alone is not a cure-all since it has definite limits of stock removal. The experienced metal finisher first prepares the surface by a polishing operation where required, and then, by selecting the correct grade of buffing compound, buffs the work to the finish desired.[4]

Buffing wheels are quite flexible and those in most common use are made from cloth in two general forms,

loose or open buffs and sewed piece buffs. Loose buffs, also sometimes called "full-disc" buffs, are manufactured from closely woven firm cotton fabrics of various grades and weaves as may be required. The layers, each a full-size disc, are usually held together with one row of sewing around the center hole.[2,7]

Pieced buffs, also made from various weaves and weights of cloths, consist of sections comprising remnants smaller than full discs and held together by continuous spiral stitches over the entire surface.[7] These discs, in other words, have several strips or pieces with outside full discs as covers; the whole assembly is held together with rows of machine sewing usually $\frac{1}{4}''$ or $\frac{3}{8}''$ apart.[2]

Bleached cloth, harder and stiffer than unbleached cloth, is used for faster cutting buffs. Coarsely woven unbleached cloth is suggested for highly colored work on soft metals; finer woven unbleached cloths are better adapted for the harder metals. While not suitable for cutting down soft metal or for use on light plated ware when working at the usual speeds, a stiff buff is used on the harder metals and for heavy nickel-plated articles.[1]

Sheepskin buffs, whether used alone or in conjunction with loose cloth discs, are employed for various coloring operations, such as coloring various metal deposits, plastics, etc.[7]

Buffing Compounds

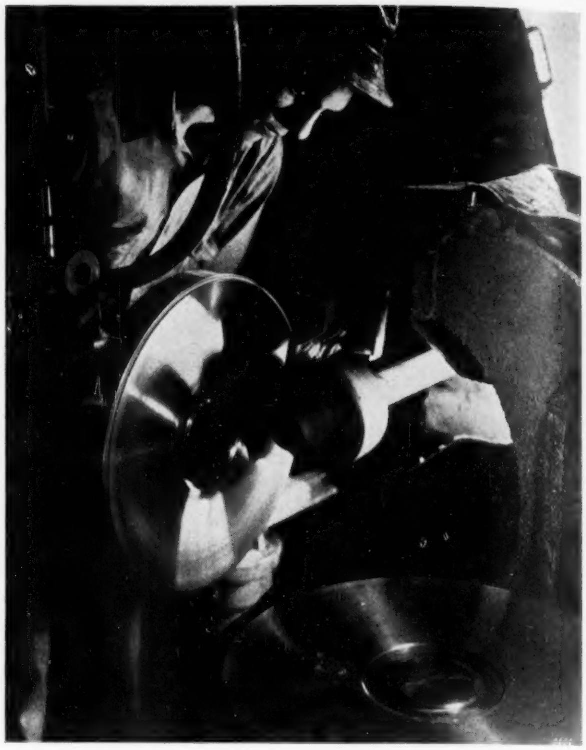
In buffing, as perhaps in no other mechanical or chemical surface-finishing operation or process, selection of the compound or compositions used is the basic determinant of the success or failure of the job. It has become axiomatic among experienced polishers and buffers to select the best possible composition for the particular surfacing job at hand if the best possible finish is to be produced at the lowest possible total cost.[15]

In virtually all instances, when buffs, wheels, labor, power, cleaning, finishing and general overhead are considered, buffing material expense is, by itself, merely a fractional part of the total cost of the operation. Yet the questions of selection and use of the best possible buffing composition for the job is an all-important consideration. Use of such a composition, accumulated plant experience has long proved incontestably, prevents excessive buff usage by reducing buff wear to a minimum, cuts labor costs, helps eliminate cleaning troubles, increases production, assures better finishes and reduces rejects to a negligible percentage. The right buffing compound will enable the operator to turn out the best possible finished product at the lowest possible total cost.[4,16]

Vital Requirements

A good buffing composition, therefore, to produce these results, should incorporate certain essentials, principally six in number. This sextet of basic requisites comprises the following:[17]

1. To stick to the face of the wheel as long as the abrasive retains its cutting qualities and no longer.



Finer abrasives and softer wheels are used in the secondary polishing operation, known as "greasing" or "oiling". Shown here is an aluminumware tray being given this treatment.

2. To so face the wheel that the work is done by the composition and not by the cloth wheel.
3. To remove defects from the surface to be buffed.
4. To clean up well on the work.
5. To be readily soluble in a suitable cleaning solution so that the finish obtained by bufing is not spoiled by the subsequent and necessary washing operation.
6. To produce the greatest number of finished parts per dollar spent in time and material, and to do so with the smallest wear and tear on the workers and machinery.

Types of Compositions

Various types of buffing compositions are used in average shop practice, among the most common being tripoli, lime, crocus and rouge, with the particular metal to be buffed and type and degree of buffing required being the principal determining factors as to which type and grade of compound should be used. Frequently, however, due to these and other operational variables, buffing compound suppliers suggest that whenever any possible doubt exists concerning choice of the compound most suitable for the work at hand, they be furnished with complete data on the nature of the metal to be buffed, shape of piece, whether work is performed manually or on automatic equipment, speed of lathe, diameter of buff and kind of buff so that they will be in a better position to recommend the particular composition best suited for the class of work in question.[17]

Molded in the ever-familiar brown or chocolate-colored rectangular cakes, tripoli is one of the oldest, most extensively employed of all buffing compositions

for cutting down and bringing out a high luster on non-ferrous metals. Providing fast cutting and coloring action, it is widely used on all types of zinc die castings, sheet and cast brass, copper-plated work, and aluminum castings and stampings.

Tripoli is carefully formulated in various grades, ranging from very dry to greasy. In buffing down non-ferrous castings and stampings, for example, a greasy grade is usually selected because the extra percentage of grease binders keeps the compound on the buff face longer and hence the cutting action is greater. On the other hand, a very dry grade proves most practical, average plant practice has demonstrated, for use on light work that requires but little surface cutting down. Buffing compounds of this grade, excellent for sheet brass or aluminum castings, small zinc or cast brass die-cast parts or for color-buffing copper-plated articles to a bright, clear finish, leave the work very clean and do not pack down in crevices or recesses, so that they thus wash out easier upon subsequent immersal of parts in the cleaning tank.[4]

Between the greasy and very dry types of tripoli compounds for non-ferrous buffing work are those which may be classified as "dry," "medium dry," and "medium greasy." Used extensively on small brass, aluminum, zinc die casting and copper-plated work, the dry grade provides a faster cutting action than the ultra-dry since it contains a larger percentage of grease binders. Despite this, is leaves the work clean and free from a smutty or greasy film.

The medium-dry type, often referred to as double-duty tripoli because it both cuts down and colors the work in a single buffing operation on numerous applications, is recommended for buffing copper-plated pieces, brass, bronze, aluminum and zinc die castings in all forms. A medium-greasy grade, due to its balanced cutting properties and coloring qualities, frequently proves an ideal compound for shops and plants running a variety of work.[4]

Another old-favorite class of compound comprises the chrome coloring rouges. Originally designed to keep costs down to a reasonable figure in color-buffing chromium-plated work to a higher and brighter luster as well as in removing stains and frosted burn marks from overplating, it is now finding increasing use, also, to bring up a mirror-bright finish on stainless steel after the metal has first been buffed down smooth with a special stainless steel buffing compound. These particular compounds are available in varying grades of cutting and coloring qualities to meet a diverse range of specific conditions that run from buffing down hard chrome-plated surfaces to badly burned chrome plate.[4, 17]

For finishing cutlery and brass work and where a high or mirror-like luster finish is required on cast iron, die castings, brass, aluminum, copper, lead, tin-plate and other soft metals and alloys, crocus compositions have proved dependable standbys. Their excellent working properties are said to leave no grease or smut on the buffed work.[4, 15, 16]

On nickel-plated work, copper, brass or other metals where high quality finishes are required, lime compounds are often used. Intended for buffing non-ferrous metals where the work surface is in good condition, free of deep tool or die marks, are the white coloring compositions. Since these possess very little cut, they are usually preceded by a cutting-down operation with tripoli when heavy die marks or similar surface imperfections are present. They impart a beautiful luster to properly prepared surfaces.[4, 15]

Still other commercially available types of buffing compound include:[4]

(1) Emery paste, really a grease or tallow stick impregnated with abrasive intended for use on a set-up polishing wheel to soften the sharp cutting action of a newly set-up wheel through lubrication and to prevent wheel from loading and glazing, and also for use on tampico brush wheels for acquiring a satin or brush finish effect.

(2) Emery cake, used in the same manner as emery paste, but preferred by some concerns because it contains higher melting point grease binders, thus making it a harder compound.

(3) Pumice grease stick, for use on tampico and fine wire brushes to produce a very light butler, satin or matte type of finish.

(4) Liquid buffing paste compound, ideal on many automatic buffing machine operations because the compound can be brushed or sprayed on the work instead of being applied to the buff in the usual manner.

Last but by no means least come the greaseless or grease-free compounds. No discussion on buffing compounds could be considered complete without commenting on these particular compositions due to their remarkably rapid rise in use in recent years. As their name implies, these compounds are made entirely free of any grease binders. With animal hide glue used as the binder, abrasive grain is blended into this glue base, forming a uniformly mixed greaseless compound. Applied to a revolving buffing wheel, the frictional heat created causes the compound to melt, resulting in transfer of a glue-and-abrasive-grain coating to the wheel. This abrasive coating dries rapidly and the wheel is ready for use.

The many grades of greaseless compounds produced, in grit sizes ranging from coarse to super-fine, permit an equally wide range of finishes and cutting actions on the work. These compositions, moreover, may be applied easily to loose or tight sewed buffs, providing great finishing flexibility.

Frequently, many metal stampings have a fairly good surface to begin with, yet all marks cannot be buffed out economically with grease-type compounds. In such instances, a greaseless composition operation, employing a tight sewed buff, is the answer to fast production. Should a bright surface be required after this, the work is often rebuffed to a high luster with one of the many grease-type buffing compounds.[4]

Wheel Speeds

Buffing wheel speeds vary widely, depending upon the particular job to be done and the material to be worked. Wheel speeds recommended by one promi-

nent authority are summarized herewith in chart form:[7]

Operation	*Material*	*Sur. Ft. Per Min.*
Cutting down	Copper alloys	8,500-10,000
Coloring	Copper alloys	6,500- 8,000
Cutting down	Nickel and Nickel Silver	9,000-10,000
Coloring	Nickel and Nickel Silver	7,000- 8,000
Cutting down	Soft metals	8,500-10,000
Coloring	Soft metals	6,500- 8,000
Cutting down and Coloring	Stainless Steel	10,000-12,000
Cutting down and Coloring	Carbon Steel	10,000-12,000

In connection with wheel speed, it should be mentioned that high speeds require good wheel ventilation if burning of buff and excessive wear are to be avoided. As previously indicated, it is quite difficult to suggest wheel speeds for any specific metal applicable in all cases since such operating conditions as types of composition, pressures and buff wheels employed vary over a wide range from plant to plant.[7]

Burring

To conclude the discussion of mechanical surface finishing techniques within this limited scope of inquiry, a few words are added on burring, or flexible polishing, as some finishers term the practice. The demand for smooth-working precision parts free of burrs, sharp corners and edges, tool and die marks, grinding lines and other surface imperfections, has risen sharply of late, focusing attention on handling the job rapidly by means of polishing wheels, cloth buffs, felt bobs, tampico fiber brushes and wire wheels.

In burring, as with polishing and buffing, the requirements of the particular job at hand dictate in large measure the type of compound to use. Suffice to say, both the grease and grease-free types are commonly employed for this work. Generally speaking, on many applications where hard set-up polishing wheels used for removing sharp burrs and edges quickly rake the abrasive from the wheel face, thus requiring a constant change to fresh wheels, the quick, easy application of greaseless compounds to hard cloth or felt wheels often provides the solution to greater output and lower costs.[4]

Conclusion

So many are the operational variables and conditions surrounding buffing, polishing and burring techniques that it has not been possible, due to space limitations, to cover the overall subject of mechanical surface finishing exhaustively. The intended purpose here, rather, has been to hit the highspots of these various operations, underscoring the fundamental factors and basic principles governing each. It is hoped that the suggestions and recommendations given herein, based on a practical study of practices utilized by many different plants and shops, will prove of some help and constructive value to those readers who may be having problems in mechanical surface finishing.

Troubles frequently may be traced to inadvertently overlooking one or another long-recognized prime requisite, and if they can be corrected through the utilization of any data presented in this series of articles, then this survey on mechanical surface finishing will have fulfilled its main, primary purpose.

There is no question, certainly, that a better understanding of the elements cannot help but be strongly reflected in turning out better work in less time and with less effort, all of which are decidedly important in these days when the climbing cost curve must be curbed and controlled on many production lines.

(References appeared in November issue.)

TESTING OF ALKALINE METAL CLEANERS

(Concluded from page 78)

between a group of very effective cleaners which can remove all but traces of residual soil. The "residue-pattern" method also is suitable for such differentiation.

Concerning the number of duplicate tests necessary in using the weight of residual soil method, it is not essential to run the four tests suggested by statistical analysis. For fairly effective cleaners (for example, those removing at least 98% of the original soil on a test panel), two tests afford good accuracy. For cleaners of lesser efficiency, there is nothing of significance to be gained in attempting to determine a more exact average weight of residual soil than what is given by two tests.

Where the cleaning test is to be used as a laboratory performance test requirement in a cleaner specification, it would seem most logical to subject the test panel subsequent to cleaning to the particular plating, painting, anodizing or lacquering operation for which the cleaner is desired in the plant, and then examine the panel for satisfactory condition. Such correlation between test and practice appears most desirable. However, it may be found expedient to make preliminary laboratory correlation tests between satisfactory cleaning and a minimum "cleaning efficiency index" or "weight of residual soil." In other cases, where for example the cleaner is required for the elimination of road dirt and grease from motor vehicles prior to repair and maintenance, the weight of residual soil method seems most applicable. In fact, the "wiping" method may be sufficient for the evaluation of such a cleaner.

For the laboratory comparison of several cleaners intended for use in a specific plant operation, for which an approximate time cycle is desired, the Nielsen method with its determination for time of cleaning is most practical.

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Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

Shop Problems

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Surface Treatment Information

Question: Please send me information on the following: yellow anozinc, black anozinc, black oxidizing, Parkerizing and Bonderizing, Iridite, Unichrome Strip, and Cronak.

C. M. D.

Answer: Yellow and black anozinc are anodic treatments for zinc for appearance and corrosion resistance. In black oxidizing the work is generally suspended in a heated oxidizing bath for short periods. Parkerizing and Bonderizing are trade names of phosphate type immersion coatings on various metals and are designated for corrosion-resistance and paint adhesion. Unichrome strip is a stripping bath for various plated coatings. Iridite is a sodium dichromate-sulfuric acid-chromic acid dip for various plated surfaces to increase salt-spray resistance or passivate the coat. Cronak is a similar dip and is composed of sulfuric acid and sodium dichromate used also to passivate coated surfaces.

Bright Nickel Formula

Question: Please send me a formula for a bright nickel solution.

M. P. S.

Answer: The Watts type nickel bath is one most commonly used in the industry for bright nickel. It is as follows:

Single nickel salts	25-45 oz./gal.
Nickel chloride	6-9 oz./gal.
Boric acid	4-6 oz./gal.
Temperature	120-160 deg. F
Current Density	15-50 Amp./ft^2

Control on this solution is important. The pH must be carefully kept between the limits, while frequent analysis (once or twice weekly) for the above contents should be made. Brighteners and wetting agents for anti-pitting are used in the order for 1/16 oz./gal. The work should be agitated for best efficiency, and constant filtration is recommended.

Pits in White Metal Plating

Question: I work with white metal castings, and after the units have been plated, there are pits in the casting and cyanide spits out overnight.

J. W. R.

Answer: It is recommended that you use weak alkaline cleaner. Plate with copper first, then nickel and a final finish coat. Do not plate too heavy a coat in cyanide solutions as trapped cyanide under the coat is causing the trouble.

Phosphate Coating for Cold Drawing

Question: We are anxious to collect information regarding the use of phosphate coatings in the cold drawing of tubes, which is a practice that was very widely used in Germany before and during the war.

A. R. K.

Answer: The process as it is applied in this country consists of annealing, pickling, rinsing, phosphate treatment, rinsing and lubricating. The phosphate coating is applied in the usual immersion manner, whereupon the work is thoroughly rinsed and immersed in a bath of drawing lubricant. The phosphate coating, being fine-grained, absorbs the lubricant, thus reducing the number of passes and improving tool life.

Light Gold Deposits

Question: We are using a solution of 1 oz. sodium gold cyanide, ½ oz. copper cyanide, and 5 ozs. sodium cyanide each to one gallon water, with stainless steel anodes, for a gold plating process. The plating time recommended in conjunction with this solution is thirty to sixty seconds. This process, however, has proved to be very unsatisfactory, for with the application of a low current the resulting finish is very light and conversely with the application of a high current the plating is very heavy and cloudy. Your advice or recommendation as to how this cloudy effect could be eliminated would be indeed appreciated.

F. G. S.

Answer: In the first place, your gold solution is not the pure yellow but rather the pink gold bath, due to the copper cyanide you have in the solution. Sodium salts, either in the gold or in the cyanide are not recommended; it is better to use the potassium salts. Agitation is necessary to obtain a uniform deposit; agitate the cathode 6 to 12 strokes per minute. With insoluble anodes, a greater tank voltage is required than with gold or part gold anodes. The solution should be heated to about 120 degrees F. A formula that should fit is as follows:

Potassium gold cyanide	¼ oz./gal.
Copper cyanide	¼ oz./gal.
Potassium cyanide	6 oz./gal.

Temp. 120 degrees F; current density, 10-15 ASF, 3 volts or less; anodes, stainless steel, agitate cathode.

Discolored Chromium Plate

Question: 1. What factors will cause the "rainbow effect" on a chromium plated surface. 2. Lead anodes are placed on the cathode bar and the current applied to electrolyze the chromium solution. I believe a steel cathode could be used as the lead is attacked by the chrome bath whenever

it is not an anode. Is this practice harmful? 3. What could be the cause of a milky appearance on a chromium plated surface? 4. What factors will cause a dull matte chromium plated surface?

L. A.

Answer: The rainbow effect in general is caused by unclean rinsing and drying facilities after chrome plating. By correcting these parts of the cycle your finish should be clean. Lead or antimony-lead bars should have no harmful effect on the bath if either are made the cathode; this is done quite often in the field. However, the chrome plating on the surface of the anode, if any, should be stripped before using as an anode again. Milky appearance is often caused by improper cleaning of the undercoat, especially if it is nickel. Be sure the undercoat is chemically clean. Another factor may be the temperature of the bath; this must be controlled. Dull matte chromium plated surfaces are in general due to unclean undercoats and the close control of temperature. All your troubles may be traceable to unclean rinse water prior to plating.

Silver Plating Brass

Question: I have trouble plating brass—if I plate silver directly on the brass, the silver seems to "bubble" and in using a mercury dip before silver plating the brass has a tendency to crack. Also, what is best possible method for removing the black film residue left on pewter after the old silver has been stripped from it?

J. F. K.

Answer: It is suggested that you plate a thin coat of bright nickel between the brass and silver. This prevents absorption of the silver by the brass. Do not use mercury dip on brass as it causes brittleness. A momentary dip in concentrated muriatic acid should remove smut from pewter. Do not clean in severe alkaline cleaner, and rinse thoroughly before plating.

Metallic Copper Content

Question: What is meant by metallic copper in the following brass-bronze plating solution:

Copper cyanide	4 oz.
Metallic copper	2.8 oz.
Zinc cyanide	$1\frac{1}{4}$ oz.
Metallic zinc	0.7 oz.
Sodium cyanide	4 oz.
Water	1 gal.

H. B.

Answer: This is free metal content of bath and is the amount you should have when analyzing the solution. To increase metallic content add enough of the metal salt to give the pure metal required.

Tin Plating with Inside Anode

Question: We have set up a sodium stannate tin bath, to plate some large containers inside and out, and as it is impossible to use a tin anode large enough to compare with the inside area due to the small opening, they turn black. By putting .001" thick of a plate, will the insoluble anode deplete our solution too fast to be practicable, and will the outside that has tin anodes be the same thickness as the inside?

R. W. L.

Answer: If you have tin anodes equivalent to or greater than cathode area, insoluble anode on inside should not deplete tin in solution. The thickness should be same inside and out by such arrangement. If work is still dark inside, suggest you fuse the tin coating to obtain brightness.

Brush Plating

Question: I want to be able to cover up soldered spots and corners on copper frames without plating equipment. How can this be done?

D. H. W.

Answer: Touching up certain areas of metal goods can be accomplished by brush plating techniques. Several firms make the necessary equipment for covering these spots with electroplated metals, so that the method can be used without special plating equipment. A number of metals can be deposited in this way. We are sending you the names of firms who can supply this equipment.

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Tanks and Linings for Electroplating

TANKS

1—Steel

Commonly made of $\frac{1}{8}$-$\frac{1}{4}$ inch hot-rolled open hearth carbon steel sheet. Surfaces should be free of heavy scale, especially if tank is to be pitch lined. All seams should be double welded. Locate drains in bottom surface or at extreme bottom of one side for complete draining. Dam-type overflow recommended for most tanks.

2—Wood

Cypress tanks generally considered best, but redwood and fir also widely used. Cost is usually about 50% higher than steel tank. Reinforcing tie-rods should be of corrosion-resistant metal. Usually used unlined, but pitch-lined tanks have been used for some nickel solutions. Best application is for water rinses and dilute acid dips.

3—Plastic

Usually confined to smaller sizes for laboratory and experimental work. Resist mineral acids and strong alkalies well. Transparency of some types often desirable. Cost is quite high. Care in choosing type required to avoid temperature problems.

4—Glass

Popular for small experimental work. Resist strong acids very well. Not recommended for strong alkalies. Large sizes made of heat-treated plate. To prevent breakage, protective screens or grids should be used on the bottoms.

5—Ceramic

Chemical stoneware tanks resist strong acids well. Unless surface glazed, material is porous. Cost is usually very high as compared to other materials. Smaller sized "crocks" very popular for miscellaneous small work and emergency operations.

LININGS

1—Rubber

Synthetic or natural rubber linings very popular for providing a non-conducting surface for acid and alkaline solutions. Not recommended for temperatures over 160 F. Rubber-lined drain connections should be provided for, as in any other type tank. Type of rubber used should be carefully considered, due to wide variation in properties of various types. Vulcanized linings superior to cemented types.

2—Lead

Plain or alloyed lead sheet very popular as a lining for tanks for sulfuric acid of all strengths. Not recommended for hydrochloric or nitric acid solutions. Weight of lining must be considered in some floor locations. Lead drains should be included.

3—Brick

Acid-resisting brick linings widely used for chrome solutions. Asphalt membrane between steel wall and brick, as well as the cement used are important to the success of this type lining. Excellent for continued use at high solution temperatures. Special carbon brick used for hydrofluoric acid and nitric acid dips.

4—Stainless Steel

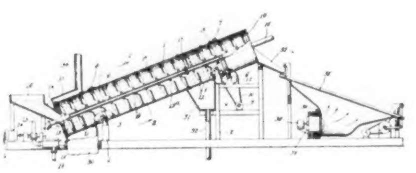
Small tanks may be made of solid material. Larger tanks lined by spraying the metal. Type of steel used for lining must be carefully chosen due to wide variation in the resistance of the various materials to chemicals. Expensive but long lived. Widely used for phosphating solutions and electropolishing solutions.

Patents

Apparatus for Cleaning and Otherwise Treating Small Articles

U. S. Patent 2,427,388. William Edward Curran, assignor to Edward Curran & Company, Ltd., August 15, 1947.

Apparatus for cleaning or otherwise treating, e.g., pickling, small articles which comprises a barrel having an inlet to admit articles thereto

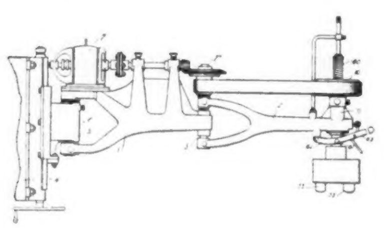


and a discharge outlet for said articles, an internal helix non-rotatably mounted with respect to the barrel for conveying articles therethrough, the faces of said helix facing the said discharge outlet being formed by a soft resilient material, means for introducing fluid for treating said articles to said barrel, and means for rotating the barrel.

Surfacing and Polishing Hard Metals

U. S. Patent 2,429,418. *Lucien Mayer.*

An apparatus for surfacing and polishing stones, marbles and other



hard materials comprising a supporting frame, rubbing tools arranged in said supporting frame, and having a tangential contact with the surface of the work, a shaft for said frame, means for rotating said frame about said shaft, means for oscillating the rubbing tools radially towards and away from said shaft in an arc about a center so as to renew the contact of the said tools with said surface, the plane of the arc being substantially perpendicular to the work surface and means to cause the said rubbing tools to take oscillating positions which are different for each turn of the supporting frame, at least for a comparatively important number of successive turns of said frame.

Copper Cleaning Composition

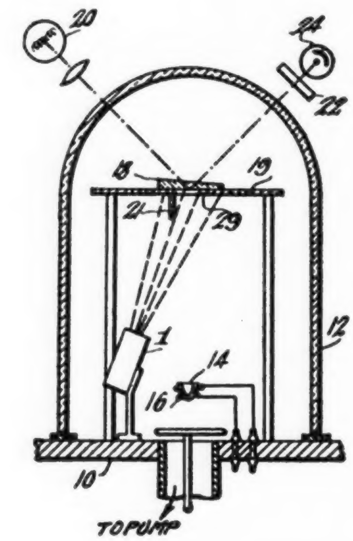
U. S. Patent 2,428,804. *Esther M. Terry & Morris Kaplan.*

A copper cleaning composition comprising approximately 5 parts by weight of sulphuric acid, 4½ parts of 30% hydrogen peroxide, 3 parts of acetic acid, and 87½ parts of water.

Hardened Optical Coatings by Electron Bombardment

U. S. Patent 2,428,868. *Glenn I. Dimick, assignor to Radio Corp. of America.*

An apparatus for producing a thin

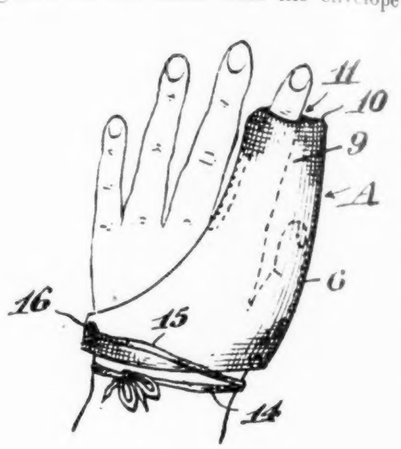


durable coating upon selected surfaces of a plurality of optical bodies, respectively, an evacuated chamber, means for evacuating said chamber, means for removably supporting said bodies to expose said surfaces within said chamber, means for applying material to form said coating simultaneously on said surfaces, and means for subjecting said coatings successively to bombardment by an electron discharge with substantially equal exposure of said selected surfaces for improving the hardness and durability of said coatings.

Thumb Guard

U. S. Patent 2,429,563. *Estella Palutzke.*

A thumb guard comprising a flexible fabric forefinger and thumb embracing envelope having a slit defining opposed flaps at its inner end for overlying the opposite sides of the hand, said envelope increasing in width toward its inner end, and means for connecting said flaps to fasten the guard on the hand with the envelope

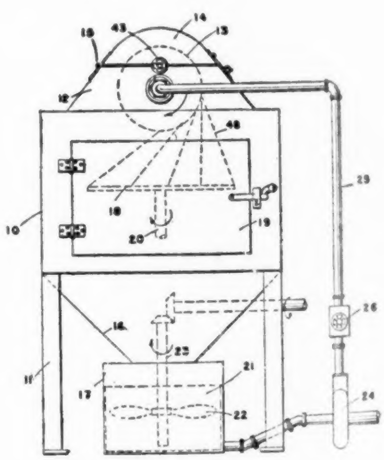


held on the forefinger and the thumb completely enclosed by and subject to movement relative to the envelope.

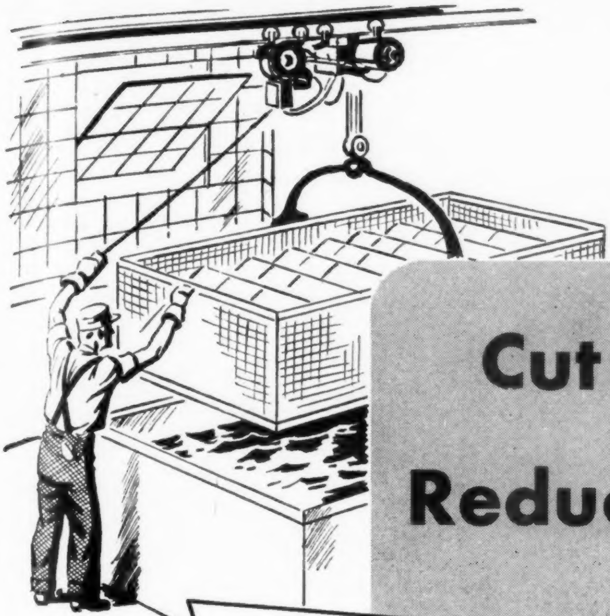
Treating Surfaces of Workpieces with Abrasives

U. S. Patent 2,429,742. *Kenneth H. Barnes, assignor to American Wheelabrator & Equipment Corp.*

In a system for directionally throwing a slurry in which solid particles are homogeneously suspended in a carrying liquid, a blasting wheel for directionally projecting the slurry, said wheel comprising a central portion, means for rotating the wheel, a plurality of blades extending from said cen-



tral portion to the outer periphery of the wheel, a stationary closed chamber within said central portion, said chamber having a discharge orifice adjacent to the inner ends of the blades adapted to discharge said liquid slurry onto the inner ends of said blades, a pressure duct terminating in said chamber,



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means for supplying said slurry under pressure to said duct, the interior of said chamber being free of obstructions, whereby the flow of said slurry from said pressure duct to said discharge orifice is unimpeded.

Stainless Steel Lithographic Plates with Copper Images

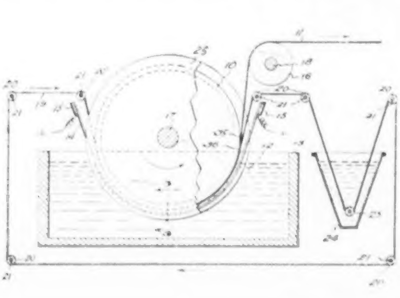
U. S. Patent 2,429,107. Torsten Petron & Erich Sternberg, assignors to Ahlen & Akerlunds.

A method of manufacturing a printing plate for offset printing, the ink repellent and ink transferring surface portions of which lie in the same plane or have a level difference insufficient for such printing processes as relief process printing and intaglio printing, the plate comprising a stainless steel surface with greasy ink repellent and water receptive properties, characterized by applying a photographic light-sensitive layer to said plate, exposing said plate, developing the resulting image and treating the portions of the plate laid bare by the development with an etching solution which contains copper chloride capable of producing a deposit of copper on said bare portions by metal displacement, said copper forming an alloy with the stainless steel having a greater adhesion relatively to water-insoluble offset printing inks than the stainless steel of the plate, and washing away the hardened remainder of the light-sensitive layer; said etching solution containing cuprous chloride and ferric chloride.

Apparatus for Producing Electroplated Sheets

U. S. Patent 2,429,902. Martin M. Sternfels, assignor to Chromium Corp. of America.

An apparatus for producing electrolytic metal foil which comprises a tank containing a metal plating bath, a metal drum having a cylindrical, electrically-conducting surface with insulated ends substantially flush with said conducting surface mounted so that a portion of its surface dips into said bath, means for rotating said drum, at least two endless insulating masking tapes spaced parallel and mounted in such fashion as to wind onto and unwind from said drum while engaging the immersed surface of said drum and covering the joints between the insulated ends and the conducting surface of the drum, thereby forming two insulated bands of drum surface separated by a conducting band, an anode, means for passing an electric plating current through said bath from said anode to said conducting band serving as cathode, whereby a deposit of electrolytic metal forms on said conducting band, means for continuously stripping said electrolytic deposit from said drum, means for separating said masking tapes from the drum surface, a tank containing cleaning liquid, means for passing said tapes into and out of said cleaning liquid while they are unwound from said drum, and means for conveying the cleaned tapes back to be rewound on said drum.



Silver Plating

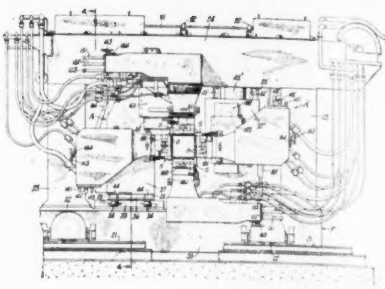
U. S. Patent 2,429,970. C. J. Wernlund & J. R. Mason, assignors to E. I. Du-Pont de Nemours Co.

A process for producing bright silver electrodeposits which comprises electrolyzing a silver-alkali metal cyanide solution containing an organic sulfur compound selected from the group consisting of 2-mercaptobenzothiazole, 2-mercaptothiazole, 2-mercaptothiazoline, thioacetanilide and trimercaptocyanuric acid in an amount sufficient to brighten the deposit within the range of 0.01 to 1 ounce per gallon.

Surface Conditioning Metal Bodies

U. S. Patent 2,429,326. Alfred J. Miller, William C. Weidner, and John Kolody, assignors to The Linde Air Products Co.

An apparatus for conditioning the longitudinal surfaces of successive rectangular metal bodies having different cross-sectional dimensions when such bodies are longitudinally propelled through the apparatus, said apparatus comprising upper, lower, left side, and right side surface conditioning blowpipe heads, each head being adapted to

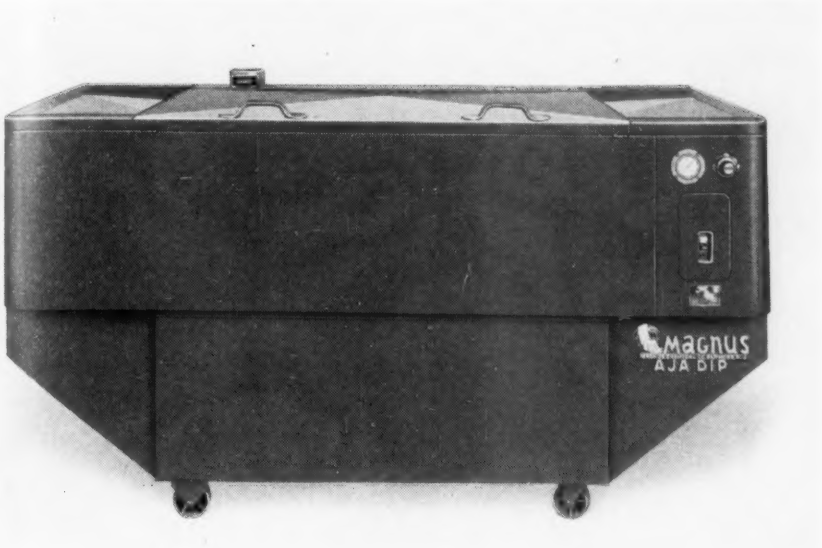


apply a gaseous stream against a corresponding one of the longitudinal surfaces of such metal body, each such head having an operating width equal to the width of the widest corresponding surface to be conditioned by it and being constructed so that the width of the gaseous stream produced thereby is adjustable to the width of any particular corresponding surface to be conditioned; a carrier for supporting the upper head and one side head; said upper head being vertically adjustable on its carrier with respect to said side head to vary the exposed width of said side head; a second carrier for supporting the lower head and the other side head; said other side head being vertically adjustable on the second carrier to vary its exposed width above the lower head; means for supporting said carriers including at least one horizontally movable carriage for moving at least one of said carriers toward and away from the body to be conditioned; and means for simultaneously adjusting said upper head and said vertically adjustable side head.

Abrasive Belt Swing Grinder

U. S. Patent 2,429,621. Henry R. Herchenrider, assignor to Minnesota Mining & Manufacturing Co.

A grinding machine comprising a frame, a plurality of rolls including a presser roll mounted in the frame for supporting an endless abrasive belt, means for driving the belt, frame-supporting pivots on the frame, a frame-supporting yoke having arms that straddle a flight of the belt, bearings in the arms of the yoke adapted to receive the pivots and thereby to support the frame pivotally, means in the yoke for opening a portion of it temporarily to permit insertion or withdrawal therefrom of a flight of an endless belt and means for temporarily supporting the frame while the yoke is temporarily open.



Cleaning Machines

Magnus Chemical Co., Inc., Garwood, N. J. Dept. MF.

The Equipment Division of the above company has recently re-designed and increased with new models its complete line of Aja-Dip cleaning machines.

The outward appearance has been stream-lined, with grouped control and instrument panel and attractive finish. The drive mechanism is entirely located in the front of the machine for easier access and servicing.

All the well-known and patented mechanical features of the former machines have been retained. In use, positive, fast cleaning is obtained by mechanically raising and lowering the platform containing the dirty parts up and down 60 times a minute through the cleaning solution with a 8" vertical stroke. This imparts a "shearing" action to the cleaning solution which actually "cuts the dirt." The vertical and fast motion of the work in the cleaning solution forces the cleaning fluid through all intricacies and recessed portions of the work, bringing new active solution into contact with the dirt with every up and down stroke.

Cleaning with the Magnus Aja-Dip Machines is fully automatic, requiring labor only for loading and unloading.

These machines are available in 13 sizes and types from the Midget type handling a few pounds of work to the Jumbo type handling 2200 pounds at a time. They may be used with either hot or cold cleaning solutions. Heat may be by steam, electricity, oil, gas or kerosene.

Bright Nickel Process

W. C. Brate Co., Albany, N. Y. Dept. MF.

Announcement is made by the above firm of its new process for producing a bright nickel deposit on brass, bronze, copper, zinc die-castings, and copper plated metals. No color buffing or burnishing is required after plating, according to the manufacturer. The material is supplied in the form of a liquid that can be added to a regular nickel solution to convert it to a bright solution, and is applicable to both still and barrel units. Baths are operated at room temperature or slightly above, and are easily controlled, it is claimed. A free analysis will be made and complete recommendations furnished to prospective users of this Lusterbright process.

Plastic Lined Pipe

Amercoat Div., American Pipe and Construction Co., P. O. Box 3428, Terminal Annex, Los Angeles, Calif. Dept. MF.

As a result of several years' research, the above concern has developed plastic lined steel pipe to permit the handling of strong chemicals. Plastic lined steel pipe combines the structural strength of steel with the well-known chemical resistance of vinyl resins, and permits handling strong chemicals in ordinary steel pipe. This product has been developed for use in chemical plants, pulp and paper mills, coal mines, and other industries where pipe corrosion is a problem.

In producing plastic lined pipe, vinyl resins are compounded with the proper chemical resistant pigments and plasticizers and are then extruded in the form of a tube. This tube has a wall thickness of fifty to sixty thousandths of an inch. The plastic tube is then placed inside steel pipe and bonded to it by a special process. The tube is flared out over the flanges providing a continuous chemically resistant liner throughout the entire piping system. Complete information can be obtained by writing the manufacturer.

Adjustable Anode Rods for Still Tanks

Hanson-Van Winkle-Munning Company, Matawan, N. J. Dept. MF.

The above company announces the development of a new adjustable anode rod for use in alkaline solutions and also chrome baths which is claimed to permit more uniform plating of irregularly shaped parts in still plating tanks.

The new device consists of brackets welded or bolted to the tank wall to which steel plates or arms, insulated on either side with phenol fiber, are pivotally attached. At the outer end of these arms are swivel fittings on which are mounted annular clamps containing insulators which surround and support the anode rod. These insulators, formed in two halves, are easily installed and clamped in place around the rods,

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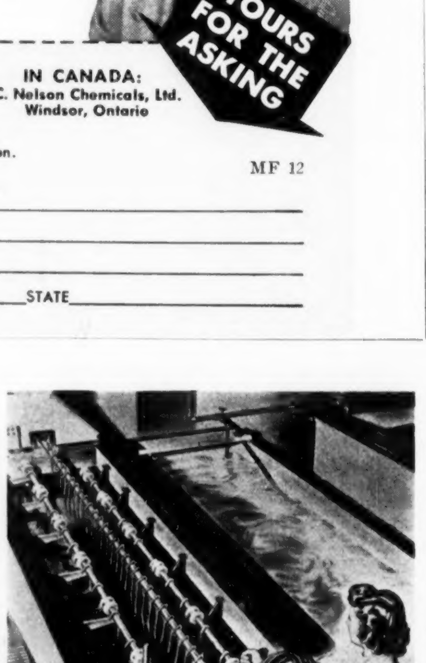
while the ball anode holders or straight elliptic anodes, as the case may be, are supported by the rod. This rod is of sturdy, simple design, capable of supporting several hundred pounds of anode material which can be moved to any desired position with a minimum of effort.

Electric current is supplied by means of a flexible cable attached to one end of the rod, while an insulated handle is provided at the other end to permit adjustment as needed.

This arrangement also has advantages when a large variety of parts are processed, which require varied anode-to-cathode distances. A more uniform deposit is claimed, because the anodes may be quickly moved to the most advantageous position relative to the work being plated.



Inconel Flexible Tubing

Titeflex, Inc., 546 Frelinghuysen Ave., Newark, N. J. Dept. MF.

The above company has announced a new flexible tubing made with Inconel innercore and braid. The hose may be supplied for temperatures up to 1700°.

The innercore of Inconel tubing is supplied with wall thicknesses of 0.005 to 0.015 inches. The thicker wall tubing is recommended for the larger sizes where high pressure is the primary requisite, and the thinner wall where the pressure is not over a few hundred pounds per square inch and the weight is critical. Construction of the tubing is said to be such as to resist failure caused by excessive vibration.

The hose may be supplied with flat ribbon or round wire braid. The flat braid is recommended for higher pressures and resistance to fatigue, especially to sizes of 1 inch or more.

Inconel flexible tubing is recommended for extreme service conditions where Monel metal or brass would be affected. Recommended applications include flexible exhaust tubing for automotive power plants, fuel and oil lines for airplanes (Zone I), for food handling, and for chemical equipment where the corrosion resisting properties of Inconel are required.

Special Long Lead Anodes

Division Lead Co., 836 W. Kinzie St., Chicago 22, Ill. Dept. MF.

Special Divco 71-Point Lead Anodes, 12 feet long with special high conductivity hooks, for chromium plating long sections of tubing and pipe, are shown in the illustration. In addition to the high efficiency and great throw

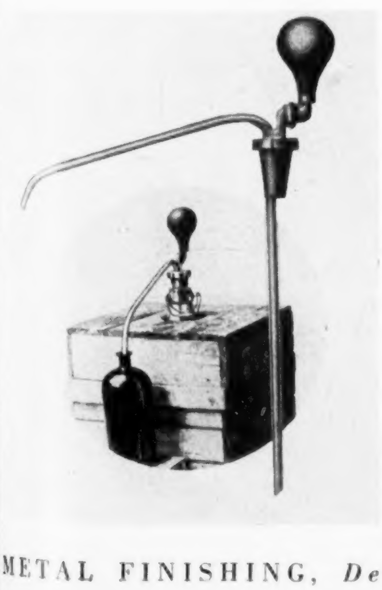
ing power of the 71-Point Design, it is claimed that the deep ribbed construction minimizes buckling and warping. Special and Conforming Anodes, as well as standard anodes, are manufactured using the 71-Point Design.

Acid Pump for Carboys

General Scientific Equip. Co., 27th & Huntingdon Sts., Philadelphia 32, Pa. Dept. MF.

A safe method of acid handling is provided by a manually-operated pump which is finding wide usage wherever liquid must be removed from a carboy, drum or barrel.

It is claimed that corrosive and other liquids flow smoothly and stop instantly, they come in contact only with the corrosion-resistant tube and



footnote on good shop-keeping

* If you want to keep your shop looking clean, start from the floor up. Use Wyandotte Zorball, the *all-purpose* floor absorbent, to remove oil, grease and other liquids quickly and efficiently.

Zorball gives an immediate anti-skid surface to soiled floors, thus reducing the danger of slipping accidents. And it is nonflammable. Even when soaked with oil, it will not readily support combustion.

Another important advantage of Zorball is that it's thoroughly safe. It is harmless to fabrics, metals and rubber, and will not irritate the skin of those who handle it.

Your Wyandotte Representative will be glad to demonstrate the effectiveness and economy of Wyandotte Zorball at your convenience. Why not give him a call today?

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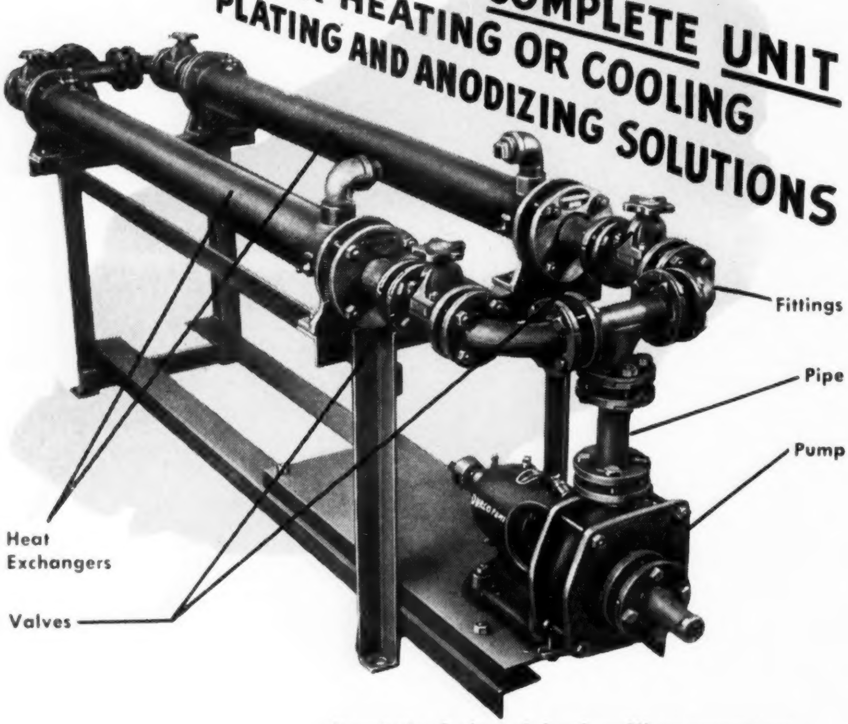


Specially designed for handling corrosives, this standard unit consists of two heat exchangers with the necessary valves, pipe, fittings and pump — all made of the well-known alloy, Duriron.

Duriron is a high-silicon iron with extreme resistance to corrosion from bright nickel and chrome plating solutions, anodizing solutions and many other corrosives.

Similar units are available with one to nine or more heat exchangers in banks, supported by one frame.

Prints showing typical layouts will be sent on request. Ask for Folder T.

DURCO
CORROSION RESISTING ALLOYS & EQUIPMENT

THE DURIRON CO., INC. DAYTON, OHIO

Branch Offices in Principal Cities

DURCO Adv. 49-GM

cannot affect other parts. When the pump is removed, acid drains completely. No tilting of the container is necessary and danger of a slip, a splash or a spill is minimized.

These pumps are supplied in hand- or foot-operated models. Either can be equipped with a lead tube for sulphuric, hydrochloric, hydrofluoric and similar acids or with a Saran (flexible plastic) tube for nitric, phosphoric, acetic acids, peroxide and many other liquids. Special tube lengths can be supplied at slight additional cost. Hand operated pumps equipped with a lead tube are $9.50 and those equipped with Saran are $11.00. For foot operation add $2.20 to these prices. Descriptive literature sent on request.

Back-Stand Idler for Limited Floor Space

The Manderscheid Company, Dept. 100, 810 Fulton Street, Chicago 7, Ill.

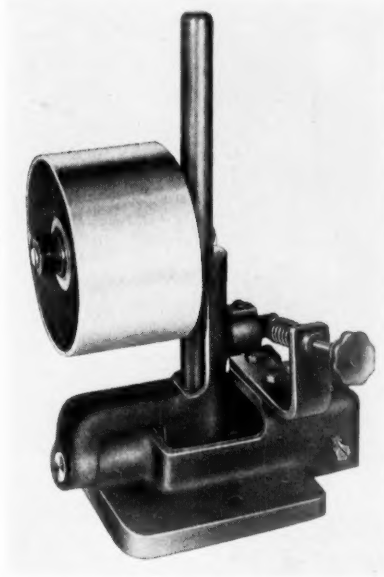
Economical conversion of standard polishing lathes to abrasive belt polishing without additional floor space is made possible by Presto Universal Back-Stand Idlers.

The unit is claimed to operate perfectly on wall, ceiling, floor or bench, making repositioning of the lathe to secure adequate space unnecessary. Leaf spring tension with a 12-inch adjustment keeps belt tight. Belt tracking is adjusted at the operator's position. Pulley is easily changed from right to left hand operation. All steel construction with sealed ball bearings.

Bench Backstand

Hammond Machinery Builders, Dept. GP-39, Kalamazoo 54, Mich.

This company has announced their No. 52 Bench Backstand "which converts existing wheel bench grinders



into high production abrasive belt units for faster, better grinding, deburring and finishing."

Because grinding wear is on the abrasive belt and not on the supporting contact wheel, the contact wheel remains true with square corners, and maintains its diameter and balance. The abrasive belt cuts cooler because there is less pressure applied while grinding, and the grinding is done over the greater abrasive area. Resilient contact wheels are claimed to eliminate work chatter and operator fatigue. Other features are as follows:

Heavy Cast Iron Base drilled for wood or metal bench installation. Dynamically Balanced Aluminum 6" dia. x 3½" Face Pulley, Sealed, Lifetime

Lubricated Precision Ball Bearings, Quick Belt Changes with Tension Release Lever, Spring Loaded Belt Tension Adjustment operated by hand screw knob and Handscrew-operated, Positive Belt Tracking Adjustment.

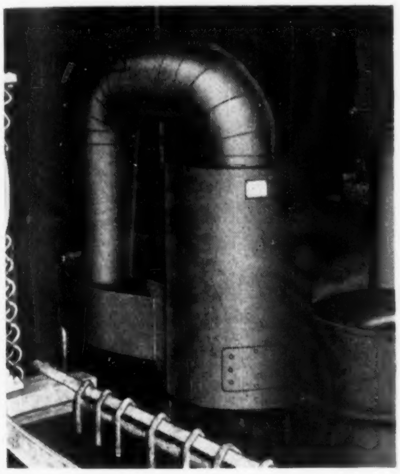
The Bench Backstand is available for left hand and right hand operation and the cost is said to be small to convert old wheel grinders into a modern high production unit.

Fume Separator

Industrial Electroplating Co., Inc., 49 W. Vermont St., Indianapolis, Ind. Dept. MF.

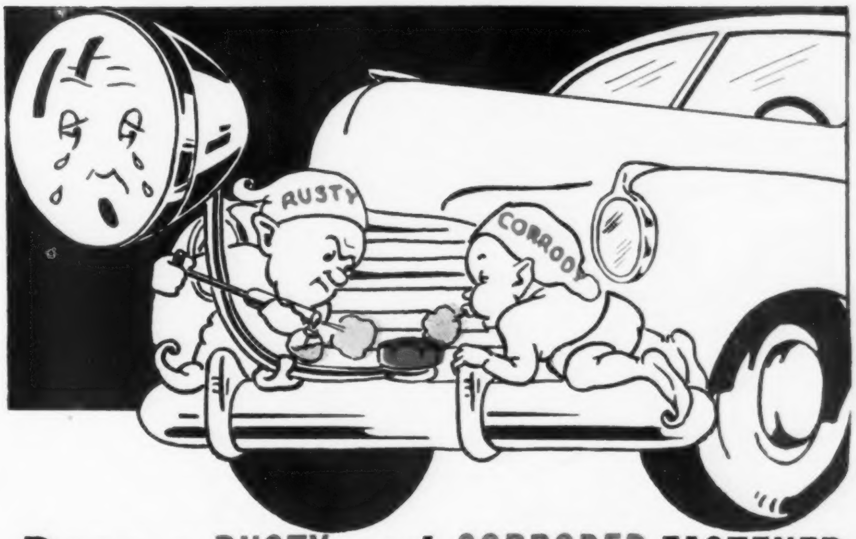
A new fume separator which cleans contaminated air without the loss of room heat has been developed by the above company.

The newly-introduced fume control unit draws contaminated air off electroplating tanks, cleans it by water absorption and centrifugal separation, and returns pure air to the shop without wasting heat. The unit is said to utilize a minimum of ductwork, making installation and maintenance simple and inexpensive.



The manufacturers recommend their air cleaner for the control of fumes from such solutions as anodizing, chromic acid, caustic soda, caustic oxydizing, sulphuric acid, and all cyanide solutions. It also is recommended for the control of fumes from ceramic paints and alkaline solutions. The illustration shows an installation on a chrome tank in a mid-western plant.

Two models are available, one having a capacity of 1,500 cfm and the other a capacity of 3,000 cfm. Each model is available with separating chambers of plain carbon steel or stainless steel.



Does a RUSTY and CORRODED FASTENER spoil your product quality?

Rust and corrosion play hob with a product's quality when they're allowed to step in and go to work on untreated fasteners. If you're faced with this kind of a problem, then Luster-on* is your answer.

Nuts, bolts, screws or wing-nuts, basket or barrel zinc-plated and treated with Luster-on*, are permanently brightened, made positively rust- and corrosion-resistant. Once Luster-on* dipped, there's no danger of their spoiling the over-all beauty and utility value of your product.

Luster-on* gives fasteners of every kind a bright new lease on life. Send the coupon and a sample for processing today. See the results for yourself. There's no obligation.

20

*REG. U. S. PATENT OFFICE

THE Chemical CORPORATION
54 Waltham Ave., Springfield 9, Mass.

THE CHEMICAL CORPORATION
54 Waltham Ave., Springfield, Mass.
Please send me full particulars about Luster-on* bright dip for zinc-plated surfaces. I am (am not) sending sample for free dip. No obligation, of course.
Name________
Firm________
Address________

Metal Finishing—December

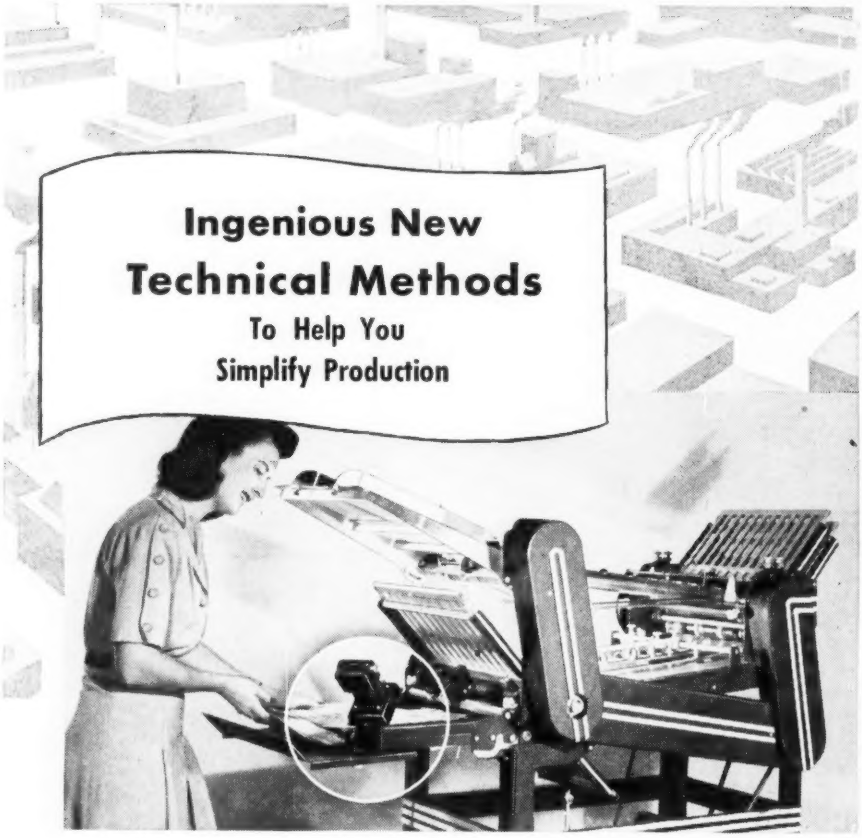
**CHROMIUM
NICKEL
COPPER**

Simple test sets for controlling these and other solutions available.

Write for Literature

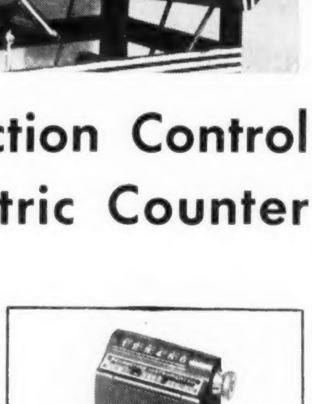
KOCOUR CO.
**4802 S. ST. LOUIS AVE.
CHICAGO 32**

Specify Kocour Sets from your supplier.



Instantaneous Production Control With Improved Electric Counter

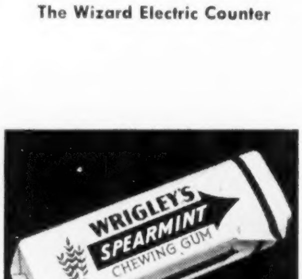
Accurate, up-to-the-minute counting of the production on this Davidson Folding Machine is done with the WIZARD Electric Counter.



The Wizard Electric Counter

New opportunities for more efficient production and elimination of over-run waste are created by WIZARD Electric Counters. These electrically-operated devices count any object or motion that will operate a switch, relay or photo-electric unit. Objects can be counted photo-electrically without physical contact and without risk to fragile or freshly-painted objects.

The Counters can be installed at any distance from the switch or photo-electric unit where the count originates. Or, they can be mounted on panels in the Production Department and arranged so that a production supervisor can maintain up-to-the-instant counts of all operations throughout the entire plant.



You can also count on chewing gum to help employee's on-the-job efficiency. Chewing gum helps relieve tension—keeps the throat moist—and prevents "false thirst" yet leaves hands free for work. That's why more and more plant owners are making Wrigley's Spearmint Gum available to everyone.

Complete details may be obtained from Production Instrument Company, 710 West Jackson Boulevard, Chicago 6, Illinois.

AB-80

Business Items

Gwyer Joins Hanson-Van Winkle-Munning

The *Hanson-Van Winkle-Munning Company*, Matawan, N. J., announces

Eugene G. Gwyer

the appointment of *Eugene G. Gwyer* to their staff of engineering.

Mr. Gwyer will be located in Matawan, working in the Engineering Sales Department.

He was formerly a pilot in the Army Air Force until his discharge on February 26, 1946.

W. M. Lee Becomes Supervisor of Pennsalt's Special Products Research

William M. Lee has joined the Research and Development Department of the *Pennsylvania Salt Manufacturing Company* as Supervisor of the Special Products Division.

Mr. Lee was formerly Chief Chemist of the *Thomas M. Royal Papers Co.*, and Research Director of the *Arabol Manufacturing Co.* of New York. In 1942 the War Department invited Mr. Lee to become Chief of the Chemicals and Plastics Section of the office of the Quartermaster General.

In this position he planned, coordinated and expedited research and development work on insecticides, germicides, rodenticides, special fuels, detergents, paints and other protective coatings, flameproofings, mildewproofing agents and water repellents for garments, molded plastics, optical films,

coated fabrics and high tensile strength laminates.

In 1945 Mr. Lee received an individual civilian citation from General Somervell for "exceptional performance of duties in connection with the Army biological control program."

Mr. Lee is a member of the American Chemical Society, Theta Chi, and Alpha Chi Sigma.

Radio Receptor Co. Buys Additional Equipment

The Radio Receptor Company, Inc., 251 W. 19th St., New York City, manufacturer of selenium rectifiers, has recently purchased the presses, dies and much other manufacturing equipment of a former rectifier manufacturer. The company plans to modify this equipment to meet the requirements called for in its process of making rectifier plates using an aluminum base, and will then install this equipment thus doubling present production capacity.

Michigan Abrasive Co. Appoints New Sales Manager

C. H. "Fid" Wills has been named general sales manager of the *Michigan Abrasive Co., Max C. Jones*, company president, announced recently.

Mr. Wills will have complete responsibility for the world-wide sales of Michigan Abrasive materials, which include sheets, rolls, discs and belts of all types and sizes.

A veteran in the Mill Supply field and widely-known throughout the Midwest, Mr. Wills comes to the Michigan Abrasive Co. after 10 years as Detroit-Toledo representative for another abrasive company.

C. H. Wills

W. D. MacDermid Appoints Conn. and Mass. Service Engineer

The *W. D. MacDermid Co.* has announced the appointment of *Mr. Maurice H. Henry* as Sales & Service Engineer for the states of Connecticut and Massachusetts. After his graduation from college, Mr. Henry entered the employ of Scovill Mfg. Co., where at the time of his leaving, he was Finishing Superintendent.

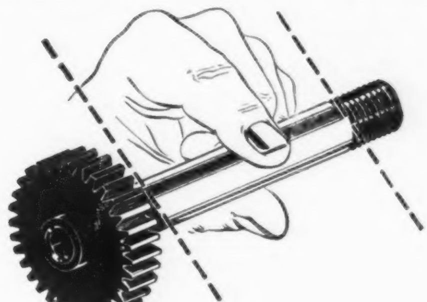
Ground has been broken for the erection of the second addition to their factory in the last two years. The new space will be used entirely for warehousing purposes and will provide additional space badly needed.

Manhattan Rubber Co. Social

Four hundred foremen, supervisors, officials and their wives, representing the production management of the *Manhattan Rubber Division, Raybestos-Manhattan, Inc., Passaic, New Jersey*, enjoyed a social evening at Donohue's Inn, Mountain View, Sunday, November 2.

John H. Matthews, vice president, welcomed the foremen and expressed appreciation for the work of the committee. He paid tribute to Manhattan's retired pioneer foremen, three of whom served the company for fifty years

UNICHROME Stop-Off Compounds



help you do the fastest job on complicated shapes

DIPPED ON—these easily melted, waxlike materials speed production of your work with sharp edges or complex shapes. Coatings withstand severe plating solutions and cleaners; won't contaminate the bath.

HARDEN AT ONCE—so coatings can be built up to any thickness desired on the double-quick.

EASILY REMOVED—by heating the work or immersing it in boiling water, depending on compound used. Melted compound can be reclaimed, so you save money as well as time.

Stop-Off 311 (Black) —For toughest cycles, including high temperature baths, boiling cleaners. Won't soften below 245F. Remove by heating or by solvent.

Stop-Off 314 (Brown) —For moderate temperatures. Won't soften below 160F. Remove by immersing in boiling water.

Stop-Off 315 (Brown) —Doesn't soften below 180F. May also be used to adjust working range of 314. Remove with boiling water.

UNICHROME

Trade Mark Reg. U. S. Pat. Off.

STOP-OFF COMPOUNDS—Products of UNITED CHROMIUM, INCORPORATED • 51 E. 42nd St., New York 17, N.Y.

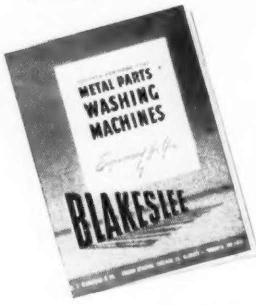
Detroit 7, Mich. • Waterbury 90, Conn. • Chicago 4, Ill. • Dayton 2, Ohio • Los Angeles 11, Cal.

Ready for the Finishing Touch!

. . . METAL PARTS ARE MORE EASILY FINISHED WHEN CLEANED IN A

BLAKESLEE

METAL PARTS WASHER



Write today for FREE booklet on Blakeslee Metal Parts Washers to answer your particular cleaning problems.

Whether the finishing operation is enameling, lacquering, machining, plating or inspecting, your washer must do a perfect cleaning job. The Blakeslee Metal Parts Washer is especially adaptable for cleaning between operations and prior to inspection . . . Continuous and batch type metal parts washers are familiar equipment throughout the automobile and aviation industries, as well as all other metal fabrication fields.

G. S. BLAKESLEE & CO.

BLACOSOLV DEGREASERS AND SOLVENT

NIAGARA METAL PARTS WASHERS

G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS
NEW YORK, N. Y. TORONTO, ONT.

and who were present at the dinner. They were *Morris G. Fitts*, *Andrew J. Gibson* and *John Dotterweich*.

Dennis J. Fenelon, personnel manager, acted as toastmaster. He read a telegram from *Charles T. Young*, former factory manager, expressing regrets on not being able to attend the dinner and sending best wishes.

Colonel Jack Major delivered a humorous but philosophical talk, as the speaker of the evening.

The committee in charge consisted of Harry V. Snyder, Emil W. Kazimer, Carl A. Anderson, Dennis J. Fenelon, James J. De Mario, Richard T. Griffith and Nathaniel Finch.

Kraft Chemical Occupies New Quarters

Recently the office personnel of the *Kraft Chemical Company* at 917 West 18th Street, Chicago, Ill., moved into renovated quarters on a lower floor of its building at the above address. The new offices feature modern conveniences as well as many improvements over the former working area.

Rows of fluorescent fixtures flood the office with illumination. A combination of light toned walls and ceilings, along with the use of light colored desks, reduces brightness contrasts and promotes seeing comfort.

For the convenience of the employees is a package kitchen, which affords complete facilities for those who bring their lunches from home, or for those who desire to prepare a light snack during the noon hour.

The air conditioning plans for this office specify 4000 cubic feet of air per minute. Thus the workers enjoy adequate ventilation as well as an even, pleasant temperature throughout the year.

The private office for salesmen and the switchboard office are partitioned from the general office by grilled glass. The switchboard operator's office features sound-proof walls, and shares an acoustic ceiling with the rest of the offices.

The old offices are being remodeled to provide additional space for laboratory facilities as well as a technical library.

Grasselli Appoints Desmond

The *Grasselli Chemicals Department* of the *Du Pont Company* announces the appointment of *Thomas J. Desmond* as sales manager for heavy chemicals. He succeeds the late *Howard E. Davis*, who died on September 13.

At the same time it was announced that a new sales planning section had been organized, with *Henry H. Wolf* as manager.

Mr. Desmond is a native of Portland, Maine. He received a bachelor of science degree in chemical engineering at the University of Maine in 1933. He joined the Du Pont Company in 1935 as a chemist at the Grasselli, N. J. works. In 1943 he was made technical sales representative at Wilmington; in 1944 he was transferred to the Milwaukee sales office and in 1946 to Minneapolis.

Mr. Wolf is a native of Newark, N. J. He began work as a clerk in the Grasselli Chemical Company's Newark office in 1924. The Du Pont Company purchased the Grasselli Company in 1928, and it became a department in 1936. From 1929 to 1939 Mr. Wolf was in the Grasselli sales office in New York. He was transferred to Wilmington in 1939 as assistant sales manager for heavy chemicals.

Change in Address for Field Abrasive Mfg. Co.

The *Field Abrasive Mfg. Co.*, formerly of 126 Ludlow St., Dayton, Ohio, has announced their new business address at 14 North Patterson Blvd., Dayton 2, Ohio. The company manufactures a variety of coated abrasive products.

New Sales Manager for Anderson Oil Co.

The *Anderson Oil Company of Portland*, Connecticut, announces that *Clyde A. Sluhan*, for several years their Connecticut salesman, has been appointed manager of industrial sales.

Clyde A. Sluhan

In this capacity he will direct the sales in the company's new expansion program.

Mr. Sluhan graduated from Ohio Wesleyan University in 1933, and for three years he was Chemist and Plant Manager at the Atlanta, Georgia plant of *Stodghill and Company*, manufacturers of textile chemicals. From 1936 to 1942 he was with the *American Cyanamid and Chemical Corporation* in charge of technical service in connection with their wetting agents. He is a member of the American Society of Metals and the American Society of Chemists.

Chicago Thrift Appoints Pettit

The appointment of *Ralph E. Pettit* as general manager of the Chicago Thrift Company, 1555 North Sheffield Avenue, Chicago 22, Ill., has been announced by *George R. Roehm*, Executive Vice President.

Mr. Pettit was formerly associated with the Aluminum Company of America where he was active in the promotion and development of Aluminum finishing methods. At the time of his leaving the Aluminum Company of America, he was Chief of the Finishes Section, Development Division.

A graduate of the University of Chicago in Chemistry, Mr. Pettit has specialized in the commercial aspects of the finishing of aluminum and he is recognized throughout the country as a specialist in organic, chemical and electrochemical finishing procedures. Immediately upon his graduation, he joined the laboratory staff of the A. P. Munning Company, Matawan, N. J., as an analytical and control chemist. Later he was associated with the Research Laboratory of the National Lead Company, Brooklyn, N. Y., assigned to special electrochemical work.

Mr. Pettit is a member of the American Electroplaters Society, Pittsburgh Branch, and the Illuminating Engineering Society.

Brown Adds to Branch Staffs

New sales and service engineering staff additions and promotions have been announced by the *Brown Instrument* division of *Minneapolis-Honeywell Regulator Co.*

Edward B. Kohl has been transferred to Corpus Christi. He was previously with the Houston branch office of the company.

I. K. Farley has been transferred

Quality-Control
Insures uniformity in every shipment

• Because McAleer will WORK WITH YOU in developing the right buffing, polishing, deburring or finishing composition for your particular job needs you will save money, time and customers by letting us develop the correct "tailored-to-fit-the-job" compositions.

The value of this McAleer Service has been written in the production records of many manufacturers. It may pay you to investigate our free consulting service.

To speed up operations and still maintain the finest finishing results in both metals and plastics, use a standard or a custom produced McAleer Composition.

May we send you our portfolio on McAleer Compositions? It will be mailed without obligation.

We always appreciate the opportunity of serving. Please write, wire or phone us if we can help you.

McAleer MANUFACTURING CO. QUALITY-CONTROLLED *Automotive-Household-Industrial* FINISHING MATERIALS **ROCHESTER, MICHIGAN**

Filter All Plating Solutions Faster, More Completely in

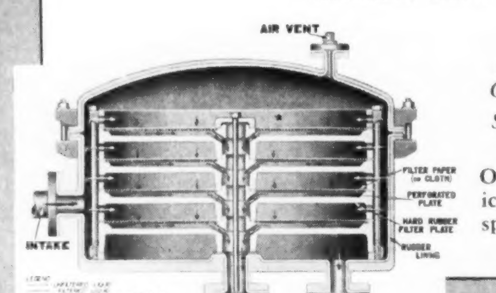
SPARKLER
Horizontal Plate
FILTERS

Because the filter cake is held horizontally, it is absolutely stable to the end of each filtering cycle. And cycles are longer because the cake retains its porosity longer. That is why the "horizontal principle," as embodied in Sparkler filters, gives you more efficient, low cost, operation. Sparkler filters are pressure-tight and leak-proof, designed for intermittent or continuous operation.

4 Plating Solution Types

1. Rubber-lined for bright nickel
2. Stainless steel for acids
3. All Iron for alkaline solutions
4. All Steel (with Stainless Pump) for chromium

SPARKLER MANUFACTURING CO.
Mundelein, Illinois



Made in Capacities
60 to 10,000 G.P.H.

See your supplier or Write for details

Our Engineering Service is available for any specialized problems.

from the Philadelphia branch office to Houston.

John D. Root, formerly instructor at the *Brown School of Instrumentation*, has been made sales engineer at Philadelphia.

E. Curt Richards has been transferred from the company's general sales department to the New York sales engineering staff.

Thomas Pitts has been appointed industrial sales engineer at the Charlotte branch office.

In line with the company's expansion of customer service facilities, it has added the following men to its branch office field service engineering staffs:

William E. Brittain, Philadelphia; *Edward J. Chance*, New York; *Ethron B. Deebel*, Philadelphia; *Gerald R. Dryden*, Syracuse; *John W. Forbes*, Albany; *Carl R. Haug*, Philadelphia; *Willard A. Holm*, New York; *Roger F. Lederer*, Chicago; *Albert J. Leonaitis*, Hartford, Conn.; *Elgin H. Lochte*, Houston; *John E. Luttrell*, Buffalo; *Kennth Shapleigh*, Boston; *Clayton K. Taylor*, Indianapolis; *Robert H. Walker*, Cleveland, and *Frank M. West*, Boston.

Gallaher Awarded Crowell Gold Medal

Edward B. Gallaher, president of *The Clover Manufacturing Company*, Norwalk, Conn., received the Crowell Gold Medal from the *Army Ordnance Association* for distinguished ordnance service. The award took place on October 1st, 1947 at the 29th Annual Dinner Meeting of the association held in the Grand Ball Room of the Waldorf Astoria Hotel in New York City.

Founded in honor of Brigadier General Benedict Crowell, Director of Munitions, 1918, and President of the Army Ordnance Association, 1919-1945, the Crowell Gold Medal was conferred on Mr. Gallaher with the following citation:

"For distinguished service in the advancement of our national economy to keep America strong. The Army Ordnance Association gratefully acknowledges the preeminent service being performed by Edward B. Gallaher, economist, manufacturer, and business executive. Through his voluntary service as author of the Army Ordnance Association Business Letter he continues to bring home the fundamental truth that our economic health is a vital factor in our national security and international peace."

Mr. Gallaher is widely known as one of the country's foremost authorities on coated abrasives, lapping and grinding compounds.

Southwest Research Institute

Southwest Research Institute, a non-profit scientific organization designed to aid Southwestern industry solve its technological problems, recently opened its laboratories and has already contracted for several projects sponsored by industrial corporations.

Dedicated in September, the Institute was built along lines of Midwest, Armour and Mellon Institutes to conduct industrial research on a fee basis. Under its charter, sponsoring manufacturers or trade associations retain patent rights on all discoveries accruing from research projects.

The Institute provides technological facilities intended to assist in improving manufacturing processes, solving industrial engineering problems, developing new materials or products, improving agricultural production, analyzing biological or chemical problems, reducing manufacturing costs, promulgating improved livestock production, solving industrial-chemical problems, exploring chemurgical potentialities, and discovering new uses for by-products or wastes.

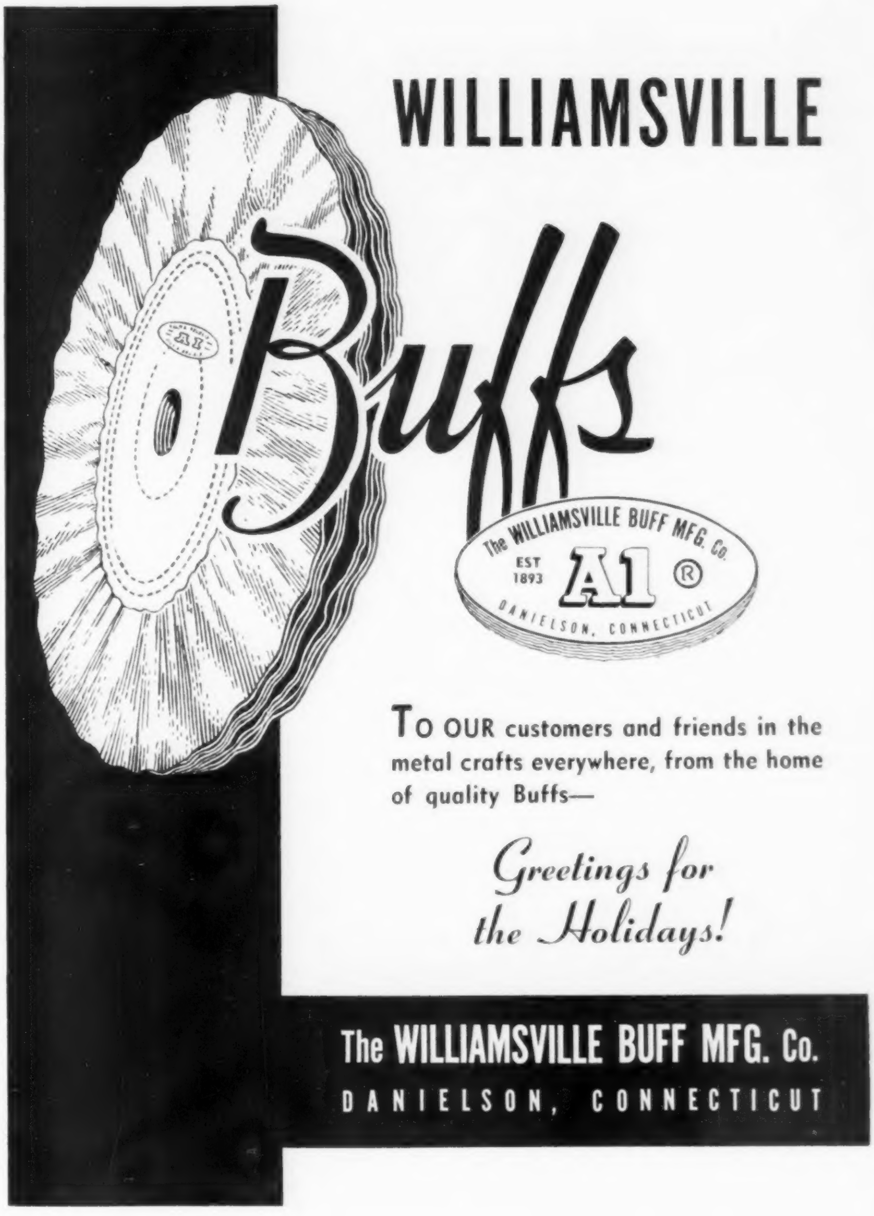
Principal members of the Institute's beginning staff include Acting Director and Business Manager *W. M. Ham-*

mond, formerly business manager for Armour Foundation; *Dr. H. C. Dyme*, chemist and bacteriologist; *Dr. John B. Loefer*, biologist and authority on microorganisms; *Robinson Brown*, graduate mechanical engineer and oil equipment expert; *Dr. Judson Swearingen*, chemical engineer and authority on hydraulics and turbines; *Dr. Paul A. Keesee*, veterinarian known for his work in artificial insemination; *Dr. F. W. Bieberdorf*, botanist and authority on plant pathology; *Mr. I. O. Gilbert*, specialist in electronics and machine design, and their assistants.

The Institute also assists deserving students of science by opening its laboratories to them and employing a limited number as assistants to staff technologists, thus providing them with practical experience of the highest order.

Another objective of the Institute is the furthering of friendly relations with Latin-America by bringing in science students from those countries to work in the Institute and on Essar Ranch, which serves as the livestock and agricultural laboratory of the Institute.

The Institute's Board of Governors includes Col. *W. B. Bates*, Houston attorney and banker; *C. F. Urschel, Sr.*, San Antonio oil man; *Mr. Earl Slick*, president of Slick Airways, transcontinental airfreight line; *Mr. Leroy Denman, Jr.*, San Antonio attorney; *Mr. James Hewgley*, Tulsa oil man; *Mr. James Goodwin*, industrial director for the San Antonio Chamber of Commerce; *Mr. George Strake*, Houston oil man and philanthropist; *Mr. John Cox*, San Antonio attorney; *Dr. Judson Swearingen*, authority on hydraulics, and *Mr. W. M. Hammond*, former business manager of Armour Foundation and presently acting director of Southwest Research Institute.



National Bronze & Aluminum Co. Obtains License for Fairchild Al-Fin Process

Fairchild Engine and Airplane Corp., New York, N. Y., has concluded a licensing agreement for use of its Al-Fin process by the *National Bronze and Aluminum Company* of Cleveland, Ohio, according to a recent announcement by *J. Carlton Ward, Jr.*, Fairchild president.

The agreement permits National to use the process for bonding aluminum or its alloys to steel and iron. The process makes possible the fabrication of bi-metallic assemblies combining the strength of steel with the light weight, high heat conductivity, excellent bearing properties, and anti-corrosion qualities of aluminum.

M. V. Little, sales manager of *Al-Fin Division*, said the Cleveland foundry intends to use the process in making bi-metallic pistons, steel-backed aluminum sleeve bearings and bushings, aluminum timing gears with bonded-in steel hubs, aluminum muffed and finned cylinder barrels, finned heat exchangers, water pump impellers, cooling radiators for power tubes, food handling equipment, finned convector heating units, and similar items, as well as aluminum coating of steel pipe and tubing for corrosion prevention.

Most of these applications already have been pioneered by the Al-Fin Division at its plant in Farmingdale, Long Island, N. Y., Mr. Little said. However, the fact that National's foundry is located in Cleveland near many manufacturers who have wide use for bi-metallic assemblies — particularly manufacturers in the automotive field —will result in better service and eliminate transportation delays, he pointed out.

The Al-Fin Division will continue to fill production orders for manufacturers who require more than one source of supply, he said, and will continue to develop new applications for the process.

This Man Will Help You CUT POLISHING COSTS

He is a General Abrasive polishing engineer. With his wide experience in all phases of polishing and grinding, he is at your disposal to study your polishing operation and make recommendations for improvement. Many manufacturers have found that they can improve production and quality and at the same time reduce polishing costs by following the recommendations of the LIONITE representative.

If you feel that changes in your wheel set-up or in any other phase of your polishing procedure might be improved, ask to have the LIONITE representative call. There is no obligation.

GENERAL ABRASIVE COMPANY, INC.

Lionite and Carbonite Abrasive Grains

NIAGARA FALLS, NEW YORK, U. S. A.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

1948 Convention News!

The Newark Branch of the A.E.S. will be host to the 35th annual convention, which is scheduled to be held on June 28, 29, 30 and July 1 of 1948 in Atlantic City, N. J.

The various committees are working earnestly and untiringly in their endeavor to make this the largest and best convention ever. The plans for a very successful industrial exhibit as well as platers exhibit are progressing very satisfactorily.

Atlantic City's convention facilities are unquestionably the finest in the world. The Atlantic City Auditorium in which the industrial exhibit will be held, is the largest and finest convention and exposition hall in America. Atlantic City is easily accessible by train, bus or plane from every part of the nation.

Los Angeles Branch

A talk on safety and safety equipment in the plating room was presented by *George Henderson* of the *Mine Safety Appliance Co.* as the feature of the educational session of the November 5 meeting of *Los Angeles Branch* of the *American Electroplaters' Society.*

Mr. Henderson's discussion on this important problem of the metal finishing business dealt with hazards in general, with emphasis on respiratory dangers and contact with materials that may cause skin irritation.

He explained that he had recently polled a number of industrial hygiene engineers to see if they regarded the plating industry as very hazardous, and was quite surprised to learn that the general opinion among such experts was that many other industries are considered far more hazardous. He cited two reasons why such views of the plating industry should be held; there is an apparent lack of evidence to show that sufficient quantities of toxic and irritating dust, mists and vapors exist in plating shops to constitute a definite hazard; and the actual safety regulations governing the plating industry are few in number.

Mr. Henderson cited an adequate ventilation system as the most important piece of safety equipment that an

electroplating shop can have.

In citing the order of hazardous operations encountered in plating shops, the speaker listed them as follows:

Chromic Acid—Inhalation of either the dust or mist, either of which is a strong respiratory irritant, is injurious. The toxic limit on this is 1 miligram in a cubic meter.

Next in order of danger were the cyanides used in copper, zinc and cadmium plating. There is often a decomposition of the solution with the liberation of highly toxic hydrocyanic acid gas. This can be absorbed through the skin as well as through the respiratory system.

Cadmium salts, and those used in cadmium plating, such as sulphate, carbonate and oxide, were 3rd on the hazard list. Cadmium is a systemic poison which is toxic at .1 milligram per meter.

Mr. Henderson mentioned another group which can, under certain conditions and in sufficient quantity, cause trouble. This group consists of arsenic, lead, and mercury salts.

The speaker also mentioned degreasing as involving certain hazards. Trichlorethylene, carbon tetrachloride, benzine, gasoline or benzol are dangerous. Inhalation of these vapors has a narcotic effect equivalent to systemic poisons.

Cleaning solutions in general are not taken to be a serious hazard, nevertheless hot alkaline solutions may be irritating to the eyes and acid dips, such as sulfuric, hydrochloric, nitric, hydrofluoric, phosphoric, or a combination of these, may have a local action on the skin and mucuous membranes.

The speaker also touched upon the hazards developing from the inhalation of minute and invisible toxic dusts resulting from buffing, grinding or polishing operations.

The business session was presided over by President *Howard Woodward.* Eight new members were initiated. These were: *R. J. Mineo* and *Gus Brigantino, Southwest Plating Co.; A. T. Cram, Keystone Plating Co.; L. Stoner, Chief Products Co.; Kim Yung, L. H. Butcher Co.; Arnold Carter, Metals Manufacturers; Glenn Boner, Superior Electric Co.,* and *M. Carter.*

Among quite a large list of guests who were introduced by Chairman Woodward was *Martin Maher* of the *Oakite Co., New York,* who served as

The "624" is flexibly dedesigned so that it can be heated by steam, gas, or electricity. Only eight square feet of floor space is required.

SMALL

IN A BIG WAY

That's the Detrex "624"—SMALL, in the floor space it occupies; BIG, in the degreasing job it does.

The "624" fits small shop layouts where floor space is limited and where parts cleaning must keep ahead of production. Solvent vapor degreasing in the "624" is rapid, efficient and economical. For best results use PERM-A-CLOR or TRIAD solvents.

Yes, standard "624's" are kept in stock for immediate delivery. Call the Detrex field representative nearest you today.

E-170R

DETREX Corporation

DETROIT 32, MICHIGAN

There's a Du-Lite Cleaner*

FOR EVERY

METAL CLEANING NEED

72

With the addition of No. 72, Du-Lite's new cleaner for aluminum, zinc, and other soft metals, Du-Lite now offers the metal finisher and production man a cleaner to meet every metal cleaning need. Compounded with Du-Lite's Titronne, a remarkable wetting agent, No. 72 Cleaner will not harm, etch, or stain soft metals, while maintaining highest cleaning efficiency—and economical, too, at 11c a pound in 375 pound drums.

29

Du-Lite's No. 29 Cleaner, also activated with Titronne, is a standard cleaner for iron, steel, and brass. Its improved detergent and water depressant properties will quickly remove and dissipate soil and heavy greases, penetrating even "the hard to get at" places created by seams, blind holes, and zigzag crevices. Used 2 oz. per gallon as a soak, electrolytic, or barrel cleaner. Sold in 375 pound drums at 10c a pound.

TITRONNE AVAILABLE FOR YOUR OWN USE

Titronne is sold for general industrial uses. Non-irritating and non-toxic, Titronne can be used in soft or hard water, and in acid or alkaline solutions. A 3% concentration will reduce the surface tension of aqueous solutions by more than 50%. Titronne may be used advantageously as an addition to metal and textile cleaners.

Your inquiry regarding either the No. 72 and 29 Cleaners or Titronne will receive our careful attention.

The Du-Lite* CHEMICAL *Corporation

110 River Road . . . Middletown, Conn.

president of New York Branch, A. E. S. from 1942 to 1946.

Don Bedwell, as chairman of the Constitution Committee, submitted a report on the committee's recommendation concerning proposed changes in the Supreme Society Constitution.

The committee reported that it favored basing representation on the size of individual branches; that it opposed the suggestion that the supreme society assume financial responsibility for the annual convention, and that the convention should be financed by the group in the city in which the meeting is held; that it favored the proposal that annual dues be assessed at an amount sufficient to provide for the support of the Society and for establishment of an adequate research fund; that it did not feel a complete new national constitution is necessary.

Rochester Branch

The December meeting and Christmas Party of the Rochester branch will be held on Saturday Dec. 13th. Reservations for the Party must be made in advance. Seven new members were elected at the meeting held on Oct. 17, including *C. B. Fideor, H. F. Fulton, F. A. Newbar, A. G. Valvano, W. J. Whitbourne, W. F. Swanton*, and *G. Macdonald*. Following the regular business meeting *Mr. Sieffen*, of the *J. J. Sieffen Co.* talked on sprayed types of buffing compounds.

Paper on Precious Metals by E. M. Wise Presented at International Congress of Corrosion in Paris

A technical paper, "*Precious Metals in the Chemical Industry*," by *Edmund M. Wise* was presented by *Dr. Maurice Ballay* before *The Societe Francaise de Metallurgie Commission Technqiue Des Etats de Surface* at the International Congress of Corrosion on Tuesday morning, October 7, 1947, in Salle B, Maison de La Chimie, 28 Rue St. Dominique, Paris, France.

The author dealt primarily with the industrial uses of the eight precious metals—the six platinum metals in particular. A large amount of new data on the corrosion resistance of these metals was summarized for convenient reference. The industrial applications of these metals and properties which are responsible or their use were discussed in detail. That they have the ability to withstand environments that would destroy other materials may be illustrated by the use of platinum in handling glass in the fiber glass industry, which was made possible by the unique resistance of platinum to molten glass.

Widespread industrial use of the platinum metals is the best evidence of the economies resulting from the selection of materials on the basis of performance, life and product quality rather than the initial cost. In their use as catalysts, the author shows that the precious metals have higher conversion efficiency and the ability to function at lower temperatures and pressures, as in ammonia oxidation and the synthesis of complex organics.

Outside the chemical field, the good behavior of the precious metals as electrical contacts is described as being due to resistance to oxidation and, except for silver to sulphidation. An excellent illustration of this is the use of palladium contacts in telephone relays in all voice current circuits, which contributes to the low noise level and reliability to telephone circuits in the United States.

Mr. Wise is in charge of the Section on Platinum Metals and Electronics of the Development and Research Division of The International Nickel Company, Inc., in New York, and has been in charge of the technical development of platinum metal uses for the past twenty years.

Dr. Ballay is Director of Research of the Centre d'Information du Nickel, in Paris, France.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS

Recent Activities

Cleveland Local Section of the N. A. C. E. meeting held in the Cleveland Public Library, Cleveland, Ohio. *Dr. R. B. Meers,* head of the Corrosion Laboratories of the *Carnegie Illinois Steel Corporation,* presented a paper entitled, *"Causes of Localized Attack."*

San Francisco Bay Area Section of the N. A. C. E. meeting held at the P. G. and E. Sun Porch, Oakland, Cal. Talks were presented on *"Cathodic Protection of the Makelumne Aqueduct,"* by *David Hendrickson,* senior electrical engineer of the *East Bay Utility District;* and *"Corrosion of Storage Tanks,"* by *Robert T. Effinger,* corrosion engineer with the *Martinez Refinery* of the *Shell Oil Company, Inc.*

Joint meeting of the *Chicago Section* of the N. A. C. E. and the *Electrochemical Society* held at the Engineer's Club, Chicago, Ill. A talk entitled, *"Causes of Localized Attack"* was presented by *Dr. R. B. Mears,* head of the Corrosion Laboratories of the *Carnegie Illinois Steel Corporation.*

Meeting of the *Shreveport Chapter* of the N. A. C. E. held at Monsour's Restaurant, Shreveport, La. A paper on *Corrosion in the Paper Mill Industry* was presented by *Mr. S. S. McGill* of the *International Paper Company.*

Dr. A. B. Kinzel Heads Engineering Foundation

The Engineering Foundation re-elected *Dr. A. B. Kinzel,* Vice President of the *Union Carbide and Carbon Research Laboratories, Inc.,* as its Chairman at the annual meeting of its Board in the Engineering Societies Building, 29 West 39th Street, on October 16th. Other officers who were re-elected included: *Dr. L. W. Chubb,* Director of the *Westinghouse Research Laboratories,* as Vice Chairman; *Dr. Edwin H. Colpitts,* formerly Vice President of the *Bell Telephone Laboratories,* Director; and *John H. R. Arms,* Secretary.

Members newly appointed to the Executive Committee were: *George L. Knight* (ASME), formerly Vice President of the *Brooklyn Edison Company,* and *Dr. Joseph W. Barker* (AIEE), President of the *Research Corporation* and former Dean of Engineering, *Columbia University.* Others to continue their terms on the Executive Committee are: *Dr. Kinzel* as Chairman, *Mr. Arms* as Secretary; also *Dr. O. E. Buckley* (AIEE), President of the *Bell Telephone Laboratories;* and *R. H. Chambers* (ASCE), former Vice President and *Consulting Engineer of the Foundation Company.*

Reports were made at the meeting on thirteen research projects aided by the Engineering Foundation during the past year. These projects were concerned with studies in such varied fields as alloys of iron, metal cutting, welding, properties of gases, riveted and bolted structural joints, hydraulics and soil mechanics.

Grants were recommended for the year 1947-1948 for the continuation of nine of the past year's 13 projects, and for the support of eight new projects.

The Engineering Foundation has now been engaged in important research activities for more than 30 years. It aided in establishing the National Research Council and its Division of Engineering and Industrial Research. It has contributed to the support of the Engineers' Council for Professional Development, which, representing some eight engineering organizations, aims at the advancement of the profession of engineering. The Foundation has supported engineering research and investigations in such fields as: arch dams for power development, arch and column design, thermal properties of steam, stability of steels as affected by temperature, plastic flow of metals, cotton seed processing, di-electrics and power cable insulation, and many other fields.

ASME

The first issue of *Applied Mechanics Reviews,* a new monthly engineering

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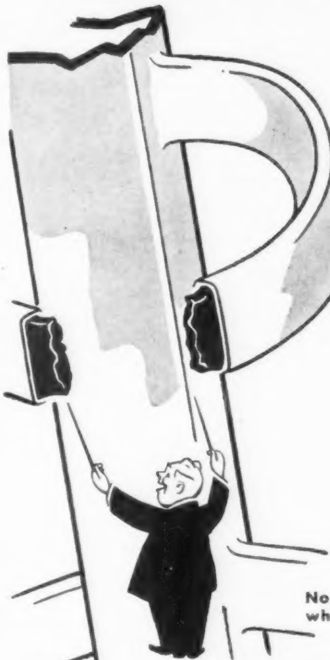

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and scientific journal devoted to reviewing current world-wide literature in the field of applied mechanics, will appear in January, 1948, The *American Society of Mechanical Engineers* has announced. Co-sponsors are the *ASME*, the *Engineering Foundation*, the *Illinois Institute of Technology* and other organizations. The business address is the Engineering Societies Building, 29 West 39th Street, New York.

Dr. L. H. Donnell, research professor of mechanics at the *Illinois Institute of Technology*, Chicago, has been appointed editor-in-chief. *Dr. S. P. Timoshenko*, of *Palo Alto, Calif.*, professor emeritus of *Stanford University*, who is internationally recognized as the dean of applied mechanics studies, will be editorial adviser.

To insure world-wide coverage, the editorial board will cull the output of some 500 engineering and scientific journals here and abroad, selecting those of greatest significance. About 200 signed reviews, written by authorities in the respective fields, are planned for each issue, of some 40 pages. Bibliographies will be included.

Reviews, each about 500 words, will deal with important theoretical and experimental papers on solid mechanics, fluid mechanics, thermodynamics, and heat transfer, as well as applications of these to geophysics, and to such specialized subjects as soil mechanics, acoustics, ballistics and lubrication.

AIME

The election of *William Embry Wrather*, of Washington, D. C., as President of the *American Institute of Mining and Metallurgical Engineers* was announced at the meeting of the Board of Directors in New York on November 19. Dr. Wrather is Director of the *United States Geological Survey*.

Announcement made by *Dr. A. B. Parsons*, Secretary of the American Institute of Mining and Metallurgical Engineers, included the election of two Vice-presidents: *C. Harry Benedict*, of the *Calumet & Hecla Consolidated Copper Co.*, Lake Linden, Mich.; and *Donald H. McLaughlin*, President, *Homestake Mining Co.*, San Francisco, Calif. Five new Directors elected were: *Newell G. Alford*, Consulting Engineer, Pittsburgh, Pa.; *Richard J. Ennis*, Gen. Mgr., *McIntyre-Porcupine Mines, Ltd.*, Schumacher, Ontario; *J. B. Haffner*, Gen. Mgr., *Bunker Hill & Sullivan Mining & Concentrating Co.*, Kellogg, Ida.; *Albert J. Phillips*, Supt., Research Department, *American Smelting & Refining Co.*, Barber, N. J., and *Cresap P. Watson*, Vice Pres., *Seaboard Oil Co.*, Los Angeles, Calif.

Elected also were six new Directors ex-officiis as Chairmen of Professional Divisions of the Institute: *A. A. Smith, Jr.* (Chairman, Institute of Metals Division) American Smelting & Refining Co., Barber, N. J.; *Irwin W. Alcorn* (Chairman, Petroleum Division), Pure Oil Co., Houston, Texas; *Gilbert Soler* (Chairman, Iron and Steel Division), Gen. Supt., Atlas Steels, Ltd., Welland, Ont., Canada; *Clayton G. Ball* (Chairman, Coal Division), *Paul Weir Associates*, Chicago, Ill.; *Curtis L. Wilson* (Chairman, Mineral Industry Education Division), Dean, Missouri School of Mines and Metallurgy, Rolla, Mo.; *Richard W. Smith* (Chairman, Industrial Minerals Division, Natural Resources Dept., U. S. Chamber of Commerce, Washington, D. C.

Dr. Wrather will formally assume his duties as president of the Institute at the Annual Meeting of the Institute to be held in February, 1948. He obtained his education at the University of Chicago, from which he received a degree of Ph.B. He worked successively as Petroleum Geologist for the Gulf Production Co.; as Consulting Petroleum Geologist in Texas and Oklahoma; Associate Chief, Metals and Minerals Division, Board of Economics Warfare; and became Director of the U. S. Geological Survey in 1943.

NATIONAL ASS'N METAL FINISHERS

Plating Waste Disposal

The *National Association of Metal Finishers, Inc.*, is devoting special attention to the problem of waste disposal. A number of platers throughout the country have been blamed by local authorities for pollution of streams and sewers by dumping waste materials without pre-treatment. One bad example was a plating concern in Michigan which dumped 3,600 gals. of plating solution containing a high concentration of cyanide into the common sewer and thereby put one of the water purification systems completely out of commission. It is feared that many municipalities intend to take action on this problem and penalize plating plants.

As yet, no standard set of procedures for the industry has been outlined for neutralizing wastes. The National Association of Metal Finishers, Inc., has appointed a committee to investigate this problem and to make recommendations to its members.

Chromic Acid Shortage

For some time past a severe shortage has existed in chromic acid which has placed a number of plating plants in difficulties.

Through the efforts of the association working with the small business division of the *U. S. Department of Commerce*, it was possible to prevent the exporting of approximately 250,000 lbs. of chromic acid between now and January 1, 1948.

The National Association has asked platers to advise them of their annual needs of chromic acid, the amount of chromic acid on hand and in stock at the present time and their needs during the coming three months. Platers are urged to forward this information as fast as possible to the *National Association of Metal Finishers, Inc., Dime Building, Detroit, Mich.* These figures will be sent to the Department of Commerce to enable them to set up quotas for the electroplating industry which it is hoped, will prevent future stringencies.

NATIONAL METAL TRADES ASS'N.

"Sound Industrial Relations for the Job Ahead" was the theme for the three day 48th Annual Convention of the *National Metal Trades Association*, held November 5, 6 and 7 at the Palmer House, Chicago, Ill. Eight hundred top management representatives of manufacturing plants from industrial centers throughout the eastern half of the United States heard an impressive group of practical speakers and saw convincing demonstrations of how "Sound Industrial Relations for the Job Ahead" could be best achieved.

Howard Goodman, Vice President of the *Goodman Mfg. Co.*, Chicago, *Ill.*, was re-elected President of the National Metal Trades Association. *T. J. Morton, Jr.*, President of the *Hoosier Cardinal Corporation, Evansville, Ind.*, was re-elected First Vice President; and *J. L. Kopf*, President of *Jabez Burns & Sons, Inc.*, New York City, was re-elected 2nd Vice President and Treasurer.

Four new Administrative Councilors were elected: *Joseph W. Crook* of the Grinnell Corp., Cranston, R. I.; *Robert Hess*, The Washburn Co., Worcester, Mass.; *Russell C. Ball*, Philadelphia Gear Wks., Inc., Philadelphia, Pa.; and *William L. Dolle*, The Lodge & Shipley Co., Cincinnati, Ohio.

Administrative Councilors re-elected included: *Howard A. Lincoln*, Bemis & Call Co., Springfield, Mass.; *H. Paul Nelligan*, Easy Washing Machine Corp., Syracuse, N. Y.; *R. A. Mitchell*, Pittsburgh Forgings Co., Coraopolis, Pa.; *Adrian Collins*, Jarecki Mfg. Co., Erie,

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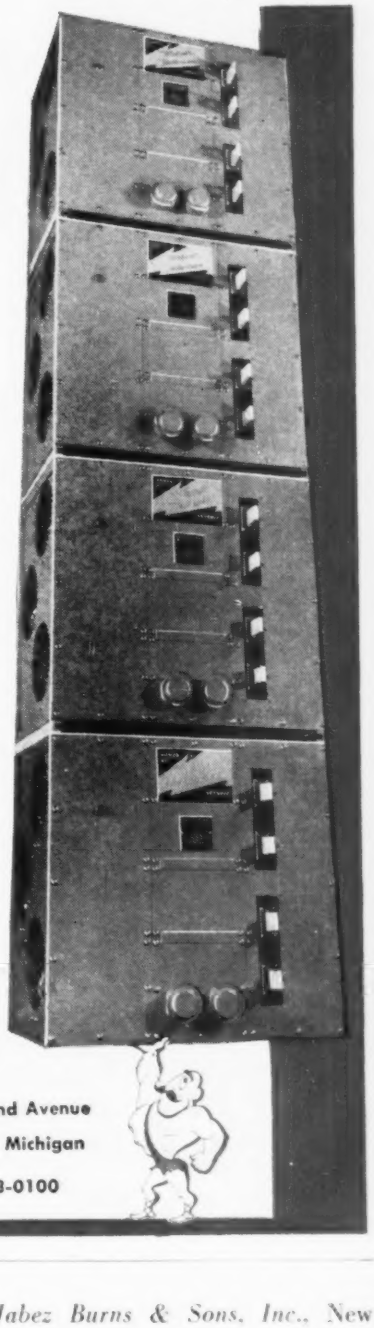

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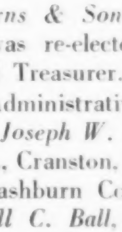

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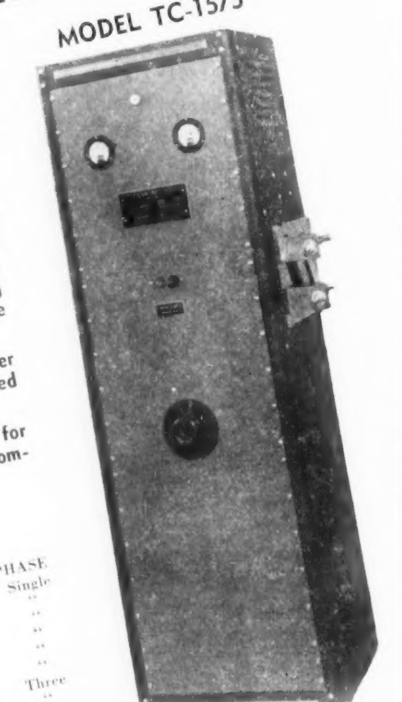

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3124	25	0-6	115	"
5510	50	0-10	115	"
2239	150	0-8	115	"
SPC 2512 T	250	0-8	220	"
SPC 3030	300	0-8	220	"
TNC 5050	500	8	220	Three
TNC 1010	1000	8	220	"
TNC 1575	1500	6	220	"
TC 1575	1500/750	6/12	220	"

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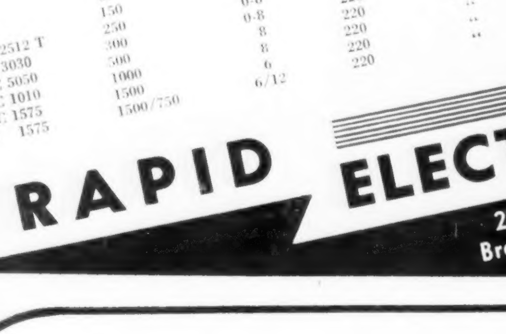

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Pa.; *J. I. Schultz*, National Broach & Mach. Co., Detroit, Mich.; *E. L. Usner*, Ross Gear & Tool Co., Lafayette, Ind.; *Harry Newcomb*, Servel Inc., Evansville, Ind.; *C. R. Rosborough*, Moline Tool Co., Moline, Ill.; and *M. E. Erskine*, Racine Tool & Machine Co., Racine, Wisc.

One of the major highlights of the three day Convention was a Testimonial dinner honoring 283 companies which have been members of the National Metal Trades Association for a quarter century or more.

On the first day of the Convention, *David R. Clarke*, N.M.T.A. General Counsel, and *John Harrington*, partner in the Chicago law firm of *Fyffe & Clarke*, discussed "Recent Developments on the Taft-Hartley Act, Wage-Hour Law and Portal-to-Portal Act". Following their talks, a series of Collective Bargaining Conferences was held, in which bargaining problems were discussed by member companies.

The Taft-Hartley Act was also discussed thoroughly by *Robert N. Denham*, General Counsel of the *National Labor Relations Board*, who spoke on the subject: "Labor-Management Relations Act — Meaning and Application."

One strongly emphasized subject throughout the Convention was effective employer-employee communications. *Eric O. Johnson*, General Manager of the *American Central Division —Avco Manufacturing Corporation*, Connersville, Ind., gave a demonstration of "A Practical Way of Teaching Employees the Economic Facts of Life". Using sound slides in color, Johnson presented the speeches he has so successfully used with his own employees in Connersville.

J. H. McNabb, President and Chairman of the Board of *Bell and Howell Company* of Chicago, together with *H. S. Monroe*, Industrial Sales Manager of the same company, presented a convincing demonstration of the value of motion pictures in developing sound industrial relations. Under the title "Your Company Should Be in Pictures", their presentation included the use of motion pictures for improving morale, for company histories, for training, for time and motion study analysis, for sales, and, of course, for employee entertainment.

E. F. Chittenden, Director of Industrial Relations for the *Unitcast Corporation, Toledo, O.*, spoke on "What's New in Supervisory Training". He

discussed all of the most modern thinking in this field.

Robert Newcomb, partner in the man-and-wife employee publication team of Newcomb & Sammons (Chicago), spoke on "Meeting the Labor Press on its Own Ground".

Dr. Millard C. Faught, Executive Vice President of *Young & Faught, Inc.*, New York City, a well-known management consultant and writer on public relations, spoke on the challenging subject: "Free Enterprise is Dying of Ignorance".

Dr. Claude E. Robinson, President of *Opinion Research Corporation*, Princeton, N. J., discussed the problems involved in "Getting Along in the Plant Community".

Frederick V. Geier, President of the *Cincinnati Milling Mach. Co.*, addressed the Convention on the subject: "America Unfinished".

Congressman *Clare E. Hoffman*, of Allegan, Michigan, a member of the joint Senate-House Committee investigating current labor problems in the United States, spoke on "The Protection of the Right to Work". Congressman Hoffman has recently been making a one man study into labor disturbances in Michigan and Ohio.

Congressman *Fred E. Busbey*, of Chicago, spoke on "Communism and How It Affects You".

Ellsworth C. Alvord, Treasurer of the *Chamber of Commerce of the United States*, and an outstanding Washington taxation expert, spoke on "Dwindling Reserves—A Problem of Business Survival".

Lee A. Freeman, member of the Chicago law firm of *Rooks and Freeman*, attorneys for the Chicago Motor Coach Company and other utility and transportation companies, discussed "Fringe Issues And Their Cost".

Mercer Lee, Vice President of the *International Harvester Company*, discussed "What International Harvester is Doing to Stabilize Works Employment Through Better Planning of Supply and Inventory".

At the Convention's 48th Annual Dinner on November 6th, Captain *Richard Conn*, Officer in Charge of the *U. S. Navy's Bureau of Aeronautics Division* of *Industrial Mobilization Planning*, and *Gene Flack*, President of the *National Federation of Sales Executives*, were the main speakers.

Captain Conn discussed the Navy Bureau of Aeronautics' Industrial Mobilization Plan—the first such presentation to industry as a whole.

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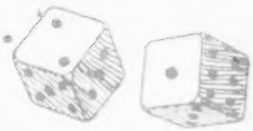

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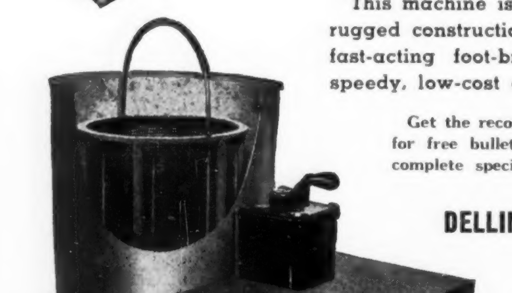

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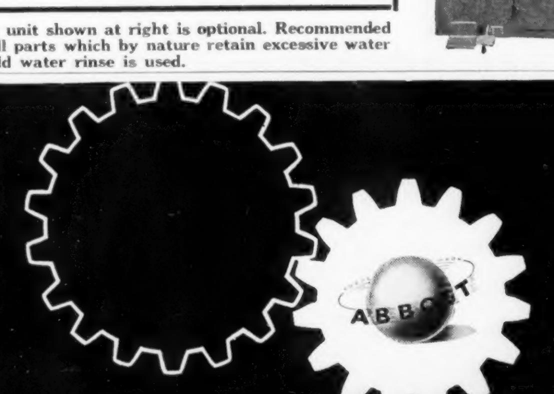

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AMERICAN SOCIETY OF MECHANICAL ENGINEERS

68th Annual Meeting

New and coming developments in nuclear energy, rocketry, gas turbines, jet propulsion fuels, safety, management and many other engineering fields will highlight the 68th Annual Meeting of The American Society of Mechanical Engineers December 1 through 5. For the first time in its history, the meeting will be held outside of New York. It will go to Atlantic City, with headquarters at the Chalfonte-Haddon Hall. An attendance of some 7,000 engineers from all sections of the country, with visitors from Canada and overseas, is anticipated.

Notable speakers will include David Lilienthal, of Washington, chairman of the Atomic Energy Commission.

The American Rocket Society, an affiliate of the ASME, will co-sponsor several sessions. Dr. Clark B. Millikan, director of the Guggenheim Aeronautical Laboratory, California Institute of Technology, will review ten years of rocket research at the laboratory. Dr. Werner von Braun, technical director of Germany's Peenemunde Rocket Research Base during the war, will speak on the development of the V-2 missile.

Among the trips arranged for the engineers will be a visit to the Atlantic City Naval Air Station with a demonstration of rocket-assisted take-off, demonstration flights of A.S.F. and naval jet-propelled aircraft and static firing demonstrations of a liquid fuel rocket engine.

Equipment and material in the fields of jet propulsion, gas turbines and nuclear energy will be on exhibition, with the war, navy, air, engineering and scientific branches of the government, and industry, invited to furnish exhibitions.

Some 240 speakers and authors of technical papers are included in the 80 technical sessions. In contrast to previous annual meetings, evenings will be free of technical sessions except for Thursday.

Honors and awards of the ASME will be conferred at a banquet Wednesday evening.

Honorary memberships will be given to Secretary of State *George C. Marshall; Harvey N. Davis,* president of *Stevens Institute of Technology*; *Everett G. Ackart,* formerly chief engineer of *E. I. duPont de Nemours & Co.*, Wilmington; and *Francis Hodgkinson*,

retired consulting engineer, formerly with *Westinghouse Electric*. Medalists include:

ASME Medal: *Paul W. Kiefer*, chief engineer, motive power and rolling stock, *New York Central System*.

Gantt Medal: *Alvin E. Dodd*, president, *American Management Association*, New York.

Holley Medal: *Raymond D. Johnson*, Fort Lauderdale, Fla.

Warner Medal: *Arpad L. Nadai*, consulting mechanical engineer, *Westinghouse Research Laboratories*, East Pittsburgh.

Melville Medal: *Raymond C. Martinelli*, *General Electric Co.*, Schenectady.

AIME

Clyde Williams, president of the *American Institute of Mining and Metallurgical Engineers*, announced that the *Charles F. Rand Gold Medal* had been awarded by unanimous vote of the Board of Directors to *Eugene Gifford Grace*, Chairman of the Board, Bethlehem Steel Corporation, for "distinguished achievement in mining administration, for distinguished leadership in the administration of all phases of a large and complex industrial enterprise; and for profound influence on the growth and health of the American iron and steel industry."

Former recipients of the Charles F. Rand Gold Medal have been: *Robert C. Stanley*, 1940, Chairman of the Board, *International Nickel Co.* (of Canada); *Cornelius F. Kelley*, 1944, Chairman of the Board, *Anaconda Copper Mining Company;* and *George M. Humphrey*, 1947, President of the *M. A. Hanna Company*, and Chairman of the Board, *Pittsburgh Consolidation Coal Company*.

The 1948 award will be presented to Mr. Grace at the Annual Meeting of the Institute in New York City in February, 1948.

Mr. Grace was awarded the Gary Medal of the American Iron and Steel Institute, of which he was president, in 1935-36.

ELECTROCHEMICAL SOCIETY

The *Electrochemical Society* has announced that its Spring Convention will be held at the Deshler-Wallick Hotel, Columbus, Ohio, on April 14-17, 1948. Chairman for this convention will be *Dr. C. L. Faust*, of Battelle Memorial Institute. At the same time, it has also been announced that the

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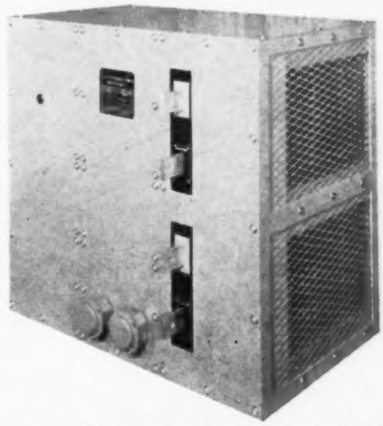

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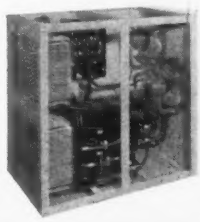

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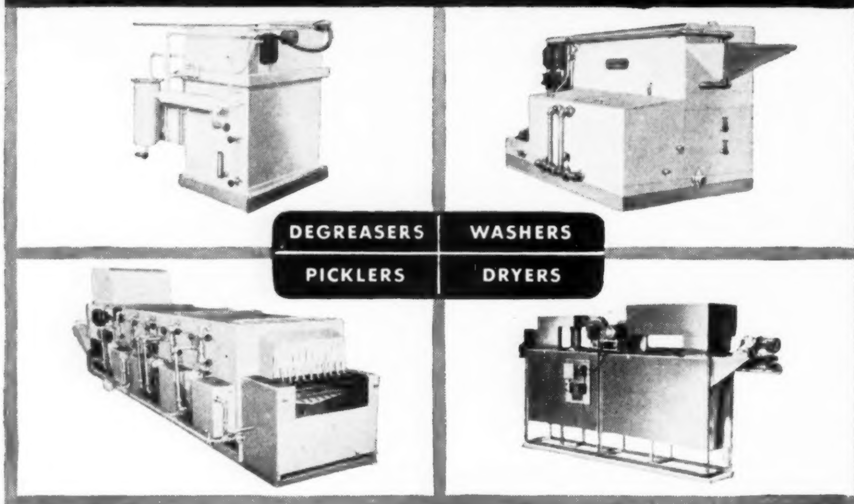

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Fall Congress will be held Oct. 13-16, at the Pennsylvania Hotel, New York City. *Dr. K. G. Compton* has been appointed chairman for this session. The Spring meeting will feature symposiums on Corrosion, Electronics, and Electrothermics, while the Fall meeting will include sessions on Electro-Organics, Electrolytic Cells, and Electrodeposition. The closing date for receipt of manuscripts of papers to be presented at the Spring Congress is Dec. 15, with June 15 as the deadline for the Fall meeting.

ELECTRON MICROSCOPE SOCIETY

The first international conference of the Electron Microscope Society of America will be held at the Franklin Institute in Philadelphia, December 11, 12, and 13.

Representing almost every field of science, including medicine, bacteriology, metallurgy, and chemistry, scientists from many parts of the world who are now using electron microscopes for research into "sub-microscopic" realms will present papers before the conference, which will be the fifth annual meeting of the Society. Delegates from England, Holland, Australia and Canada will participate in the conference.

News from California

By Fred A. Herr

Royal Plating Co. of *Los Angeles* has completed a $40,000 expansion program which doubled the area and capacity of its metal finishing production facilities. The firm has taken over a 50 x 100 foot factory adjacent to its existing shop of similar dimensions at 791 East 15th St., and has concentrated in the new section all its bright nickel, chrome, copper, brass and bronze activities. New equipment now completely installed consists of two cadmium nickel and one bright nickel tank, which supplement chrome, brass and bronze tanks moved over from the other shop. The tanks are all 800-gal. capacity and are served by an overhead crane-way to facilitate the handling of large work pieces. This department also contains two cleaner, two rinse and two sower wet tanks. The floor of the shop is undercut to

accommodate a drainage ditch. All pipes and bus bars likewise are installed under the floor. An enclosed generator room (7 x 15′) houses a 4,000 ampere generator.

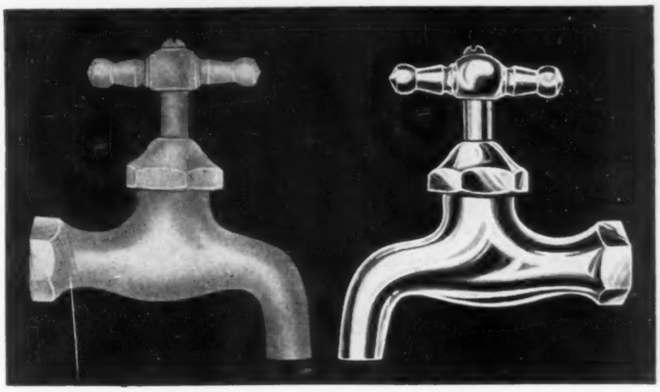
The hold-over tin, cadmium and zinc solution tanks in the original shop have been supplemented by a new 22 foot tin tank and a 22 foot cleaner tank. Since considerable amounts of 22 foot tubing are handled in this department, an overhead crane has been installed. The company also finishes tin refrigeration and radio parts in bronze and oxidizing. *Frank Burrum* is the owner and *Al Thompson* plating department manager.

The *Eldred-Kent Laboratory* is now located at 791 East 15th Street, Los Angeles, where *D. N. Eldred*, formerly for many years with the *DuPont Co.*, and *George M. Kent* have established a well-equipped facility for plating analysis and solution appraisal work. Formerly at 223 N. San Fernando Road, Los Angeles, the laboratory was moved to the second floor of the Royal Plating Co., building when Mr. Eldred became affiliated in the enterprise with Mr. Kent.

With the manufacture and finishing of casket hardware as their specialty, *Carl Veneman* of Costa Mesa, Calif., and *Marc Pierce*, son of the founder of *Pierce Bros.*, prominent Los Angeles mortuary firm, have opened a new $40,000 factory, die casting and plating plant at 15th and Newport Avenues, Costa Mesa, Orange County. The plant is housed in a newly constructed 50 x 100 foot one-story building. The plating department is equipped with 17 tanks, including four plating, one oxidizing and a high-speed copper. A $6,000 die casting machine (the firm makes its own castings for casket handles, hinges, etc.) and three new lathes are among the other major equipment items on which installation has been completed.

Foster Markolf, general manager, and *Ray Bray*, plating superintendent of the *Crown City Plating Co.*, Pasadena, Calif., have advised us that the firm has completed construction on a new production plating plant equipped to handle as high as 75,000 pieces of polished chrome daily, the bulk of which consists of plumbing fixtures and hardware. The firm also recently opened for operation a new 20 x 50 foot barrel plating building equipped

BRILLIANT LUSTROUS DEPOSITS WITHOUT COLOR BUFFING ... AN IDEAL BASE FOR CHROMIUM



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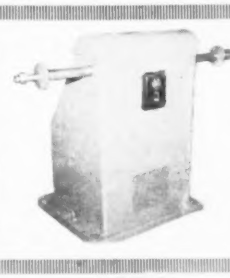
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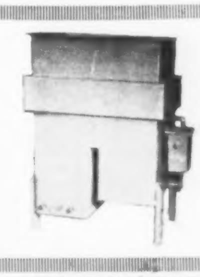
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with four 1000 lb. capacity tumbling barrels, supplemented by sorting tables, stock bins, electric hoist, etc. In this department the firm handles a wide variety of small work, ranging from ball point pens to bottle caps and thimbles.

"Carload Andy" Ospring, who covers the San Fernando Valley area of Los Angeles County as sales engineer for the *Sundmark Supply Co.* of Los Angeles, reports continued activity in that area in the form of new plating and organic finishing shops, and expansions of existing ones, particularly in the heavily industrialized Burbank and Glendale districts.

Quality Plating Co., Burbank, has installed a new automatic polishing machine, the first of four such units it is adding to its equipment for production plating.

Meyer Roter, formerly active in the plating field in Newark, N. J., is now owner-operator of the *Artcraft Plating Co.*, Burbank, which he has equipped with $10,000 worth of new facilities to specialize in the plating of plastic and aluminum items and plaster statues.

J. C. Blair & Sons, Glendale, have completed equipping a new polishing shop for job polishing, outfitted with some $5,000 worth of equipment, including three new lathes. The shop is operated by *J. C. Burke* and two sons, *Bob* and *Joe*, former servicemen.

Visiting Los Angeles and San Francisco in November on a business trip for his firm, *Oakite Co.*, New York, was *Martin Maher*, past president of New York Branch, *American Electro-Platers Society*. His schedule called for a visit to the San Francisco-Oakland area after completing his stay in Southern California.

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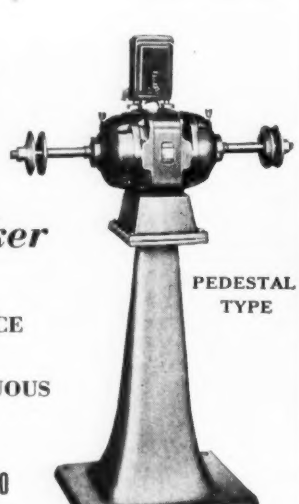

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Heavy Protective Coating for Racks

United Chromium, Inc., 51 E. 42nd St., N. Y. C., Dept. MF.

An elastic, baking synthetic, the thickness of which can be varied by application method, is described by the above concern in new 4-page bulletin on Unichrome Coating "218." Though dealing mostly with application of Coating 218 on electroplating racks, the information indicates its advantages for use on any parts or equipment which need extra-tough coatings.

Selenium Rectifiers

Rapid Electric Co., Dept. MF, 2847 Middletown Rd., Bronx 61, N. Y.

Selenium Rectifiers, a bulletin, shows bench and floor models in sizes from 50 amperes at 0-10 volts to 1500 amperes at 2.5-6 volts. Factors of construction emphasized are fine voltage control, extra large rectifier stacks, and solid construction.

Illuminated Inspection Magnifier

E. W. Pike & Co., Dept. MF, 492 North Ave., Elizabeth 3, N. J.

A complete catalog on the Pike Flash-O-Lens, illuminated magnifier used for all types of inspection. All models, both battery and electric types, are illustrated and priced. Detailed information on the uses of Flash-O-Lens in these fields is given: Metals and Metal Products, Milk—Dairy Products, Paints—Finishes, Paper—Labels—Stamps, Photograph—Engravings, Sand—Glass Products, Seeds—Grain, Textiles, Medical Examinations and Plant First Aid.

Surface Treatments for Aluminum

American Chemical Paint Co., Dept. MF, Ambler, Pa.

A bulletin describes their Alodine process for imparting surface protection to aluminum parts. Illustrations of comparative corrosion tests, typical

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layout of a processing cycle, and other pertinent information are included.

Control and Test Equipment

La Motte Chemical Co., Dept. MF, Towson 4, Md.

A service bulletin covering the various test and control sets manufactured by them. In addition to the electroplating sets for pH and solution control, the bulletin describes sets for checking boiler feed water, chlorine content of water, soil, blood, urine, and fish liver oil. Complete descriptions and prices are given for each set. Also featured is a line of water-soluble Sulfonephthalene pH indicators.

Industrial Safety Equipment

Industrial Products Co., Dept. MF, 2820 N. Fourth St., Philadelphia 33, Pa.

Bulletin covering a line of safety items for industry. Plastic aprons and sleeves, synthetic rubber and leather gloves, safety cradles for drums and barrels, grips for lifting empty drums, freight car door openers, and safety signs are among the articles described.

Woven Wire Conveyor Belts

The Cambridge Wire Cloth Co., Dept. MF, Cambridge, Md.

A 56 page booklet consisting of a series of articles on "Woven Wire Conveyor Belts for Industrial Applications." Subjects treated are as follows: Metals and Alloys used in Conveyor Belt Construction; Types of Conveyor Belt Construction; Woven Wire Conveyor Designs; Installation and Operation of Woven Wire Conveyor Belting; and the Application of Woven Wire Conveyor Belting.

Hydrogen Ion Tables

R. P. Cargille, Dept. MF, 118 Liberty St., New York 6, N. Y.

"pH Tables for Electroplaters" is a publication containing a comprehensive tabulation of plating baths, listing the permissible pH range with the optimum pH for each bath. References to original articles are cited for each process and information is given regarding how photocopies of these articles may be obtained.

These tables are issued especially for use with the new Cargille set of pH papers which provides a pH test paper selected for each of the plating processes. The tables and the set of test papers are designed to eliminate platers' production troubles resulting from lack of pH control.

Brightening and Protective Treatment for Zinc Plate

United Chromium, Inc., Dept. MF, 51 East 42 St., New York 17, N. Y.

Unichrome Clear Dip, a 4-page bulletin, presents the features of a process said to convert ordinary zinc plate into a brilliant, corrosion-resistant finish. Advantages to product finishers in using zinc plate together with this chemical treatment are discussed, and the typical production cycle for the process is described.

Handling Production Parts

Stanwood Corp., Dept. MF, 4819 W. Cortland St., Chicago, Ill.

Catalog No. 16 is the most comprehensive yet published for the presentation of Stanwood baskets, trays, fixtures, retorts, carburizing boxes,


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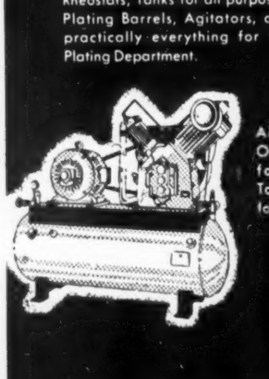
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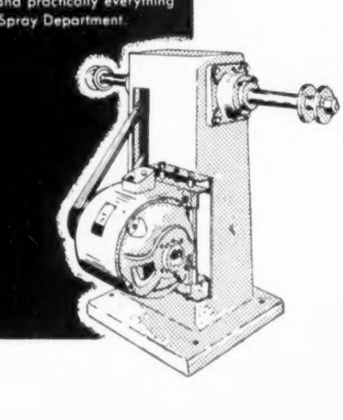
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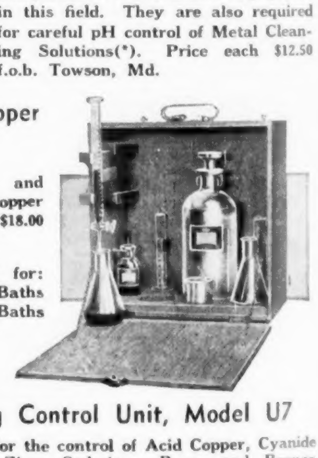
The active acidity and alkalinity of electroplating and electrotyping baths (*) for the uniform deposition of metal are now universally controlled by the pH method. LaMotte Block Comparators are standard equipment in this field. They are also required for careful pH control of Metal Cleaning Solutions(*). Price each $12.50 f.o.b. Towson, Md.

The LaMotte Acid-Copper Analytical Set


For accurately determining and regulating both the acid and copper content of the bath. Price $18.00 f.o.b. Towson, Md.

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Control of Chlorides in Plating Baths
Nickel-Chloride Control in single unit.
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(*) Reports on various Plating Control Processes are available without obligation. Write for them.

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The Osborn Mfg. Company, Dept. MF, 5401 Hamilton Ave., Cleveland, Ohio.

Catalog No. 200, 76 pages in three colors, presents numerous illustrations of industrial brushing operations in addition to photographs and descriptions of Osborn's complete line of power, paint, varnish and maintenance brushes.

The new publication contains many innovations, including a three-page digest of the origin of Osborn brush materials from many parts of the world, a three-page section devoted to factors involved in selecting the right brush for specific jobs, and including operating equipment requirements, brush characteristics, operating conditions, surface speeds and other helpful information regarding brush usage.

Many of the photographs which illustrate the various types of brushes show them in actual use, thus giving readers the advantage of seeing various types of brushing setups.

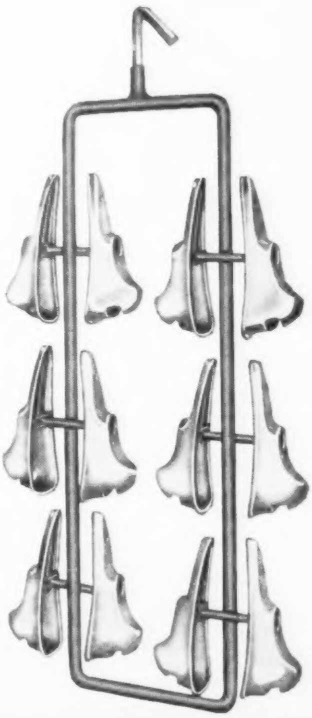
Full information on Osborn's complete line of wire and fibre wheel brushes, paint and varnish brushes and maintenance brushes is also included.

Centerless Belt Grinding

Porter-Cable Machine Co., Dept. MF, 1714 North Salina St., Syracuse 8, N. Y.

A folder in which the benefits to be derived from the centerless belt grinding method are fully discussed and illustrated. Complete specifications are given. The bulletin is not a sales bulletin but presents concrete information for the production and plant engineers on a moderately-priced method for reducing costs and increasing production on centerless grinding operations.

ONE COAT PASTE INSULATION for PRODUCTION RACKS



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TECHNICAL LITERATURE

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***Rempe Engineering Data Book.* Published by the Rempe Co., Dept. MF, 340 N. Sacramento Blvd., Chicago 12, Ill. 34 pages. Price $1.50.**

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It treats heat transfer "K" factors for all ranges of heating and cooling from minus 60 to plus 350 degrees F.; gives recommended air velocities and fin spacing for fin coils; shows in detail how to calculate and design pipe and fin coils for all generally encountered heating and cooling loads.

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tions for both pipe and fin coils, the book treats such subjects as inspecting, testing and finishing of coils, calculation of heating and cooling coils, methods of computing fin coil surfaces, application of coils to particular types of heating and cooling units, and properties of saturated steam. The book is illustrated and has many pages of tables.

Treatment of Spent Pickling Liquors

Treatment of spent pickling liquors containing sulfuric acid and iron sulfate, by George M. Ornsen. Published by Office of Technical Services, Department of Commerce, Washington 25, D. C. 46 pages mimeographed. Price $1.25. Checks payable to the Treasurer of the United States.

Processes employed in Germany for recovering iron sulfate from spent pickling liquors are described in detail in a report now on sale by the Office of Technical Services. Besides recovering the iron sulfate, the processes check pollution of streams and public water supplies and improve the pickling operation itself, the report states.

The report was prepared by George M. Ornsen, consulting sanitary engineer, New York City, following an investigation of the processes in Germany under OTS sponsorship.

Although the processes were developed primarily to check stream and water supply pollution and recover iron sulfate, experience shows that the processes give more uniform results in pickling operations and require less supervision, according to the report. Above certain concentrations the iron sulfate acts as a pickling inhibitor so that lesser quantities of other inhibitors need be used.

The several types of pickling and iron sulfate recovery processes are described in detail in the report. Information on equipment and labor required, 11 drawings illustrating machinery and other operational data are included.

In German recovery plants in 1941 in which sulfuric acid consumption amounted to 24,875 tons, iron sulfate recovery totalled 15,700 tons, a low rate presumably due to the wartime emphasis on production of essentials rather than byproducts. Mr. Ornsen estimates that over 100 recovery plants have now been ordered or installed in Germany.

Before the war about 6,000 tons of

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recovered iron sulfate were sold for agricultural purposes—combating weeds, treating seed grain, killing insect pests, and the like. About 1,200 tons were used as a flocullant for water purification in place of aluminum sulfate. Some was also used in tanning, dyeing, and wood preserving.

As in America, the Germans have also treated iron sulfate with ammonia, mainly in aqueous solution, to produce ferric hydroxide and ferric oxide (by chemical precipitation), and ammonium sulfate. The ferric oxide is used as a pigment for paints and as a polishing material in the optical industry. The ammonium sulfate is used as fertilizer.

The investigator believes that German experience with iron sulfate recovery in Germany, and other countries as well, "should definitely prove that iron sulfate recovery from spent pickling liquors has passed the stage at which its usefulness should still be doubted. . . . The process, from every viewpoint, has become an established fact, with a sufficient number of advantages in its favor to render its installation worthwhile."

Obituary

WILLIAM HODECKER

William Hodecker, Sr., of *Hodecker Bros.*, 73 N. J. R.R. Ave., Newark, N. J., died on Saturday, November 1, 1947. He was 80 years of age.

The firm of Hodecker Bros. was founded in 1893 and has been in continuous operation ever since. The management of the concern is now in the hands of *Edward Hodecker* and *William Hodecker Jr.*, and will continue under its present policies.

Mr. William Hodecker was known throughout the country as one of the pioneers in the job plating industry. He was universally respected for his industry, ability and integrity. He was active in his work up to within a few days of his passing.

Surviving relatives are his wife, *Mrs. Dorothy Hodecker* of Newark, N. J., his son, *William Hodecker Jr.*, his daughter, *Mrs. Theodora Seymer* of E. Orange, N. J., his sister, *Mrs. George H. White* of Pittsfield, Mass., and his brothers, *Edward Hodecker* of Newark, and *Charles Hodecker* of Pittsfield, Mass.

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1—HANSON-VAN WINKLE CO. 4000/2000 Amp., 6/12 V, 490 RPM, (220/440 V Motor), Sep. Exc. PRICE $3000.00.
1—GENERAL ELECTRIC CO. 2000/1000 Amp., 6/12 V, 1200 RPM, (220/3/60 Motor). PRICE $1650.00.
1—HANSON-VAN WINKLE CO. 4000/2000 Amp., 3/6 V, 490 RPM, (550/3/60 Motor). PRICE $2250.00.

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INDEX TO VOLUME 45

METAL FINISHING, January-December, 1947

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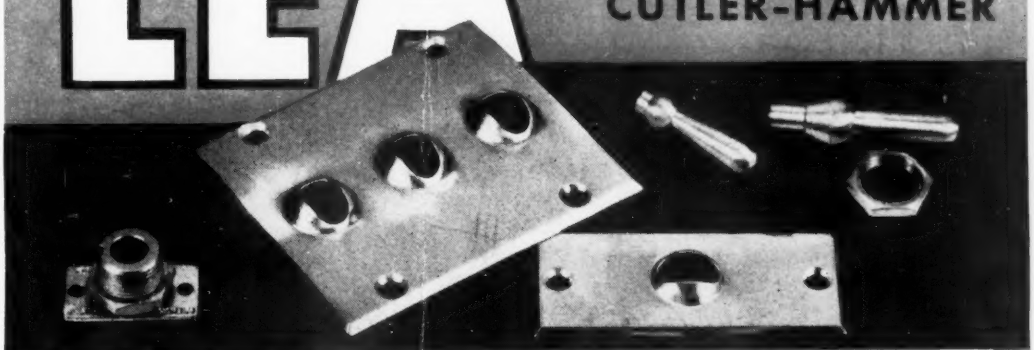

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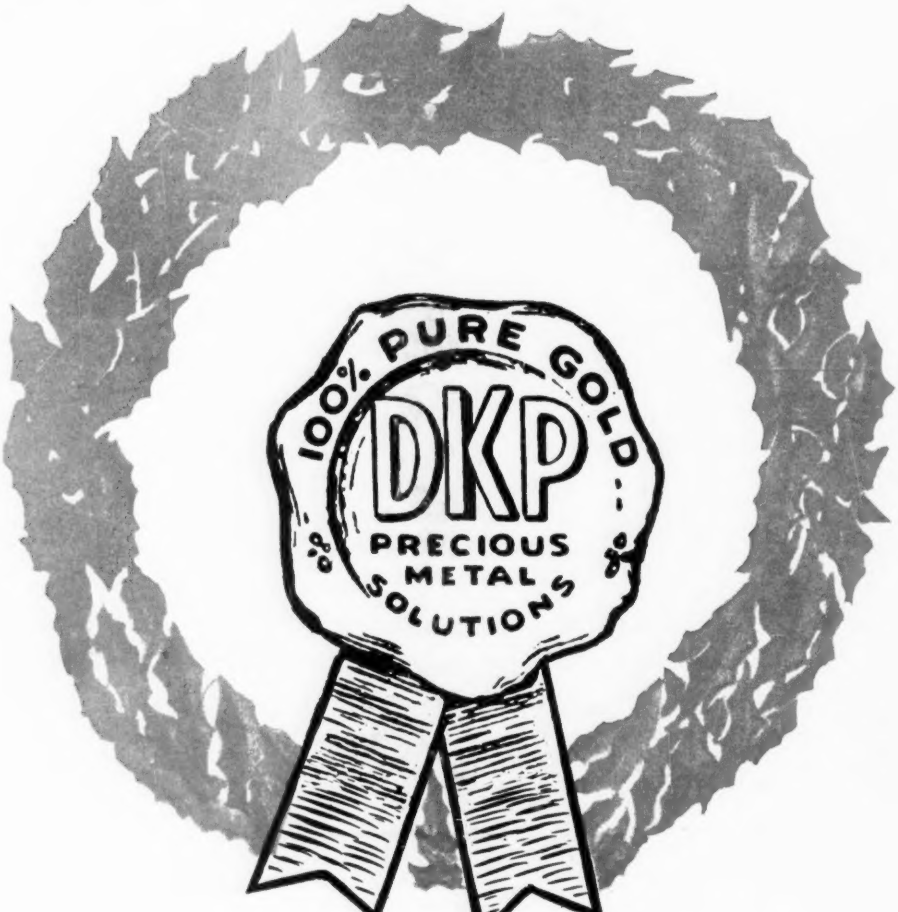

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